The Chemical Age

VOL LXIV 17 FEBRUARY 1951 No 1649

Safety First

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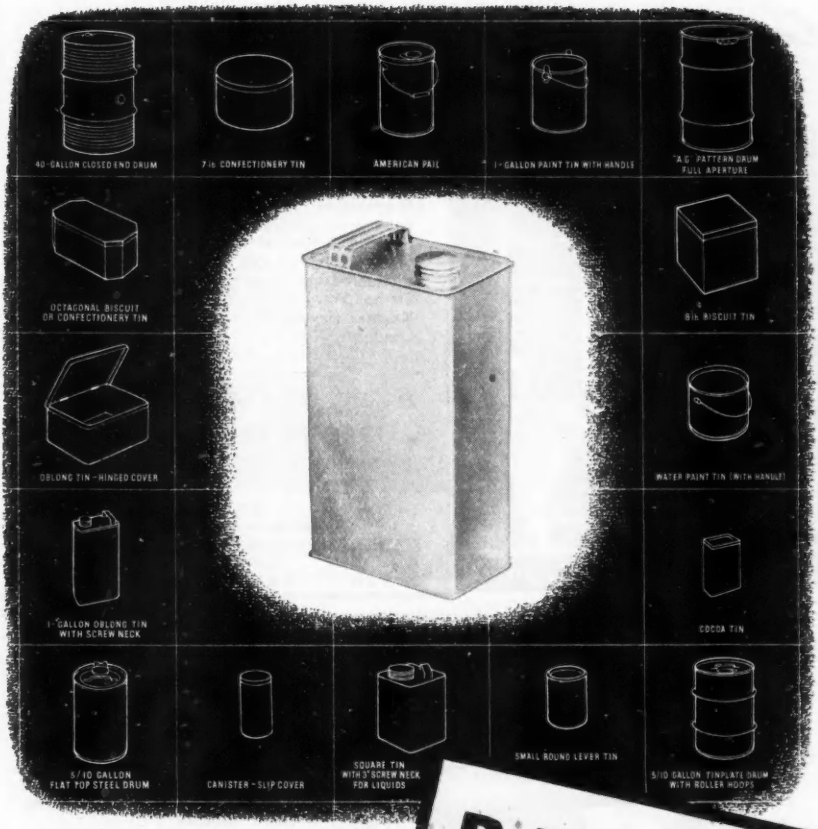

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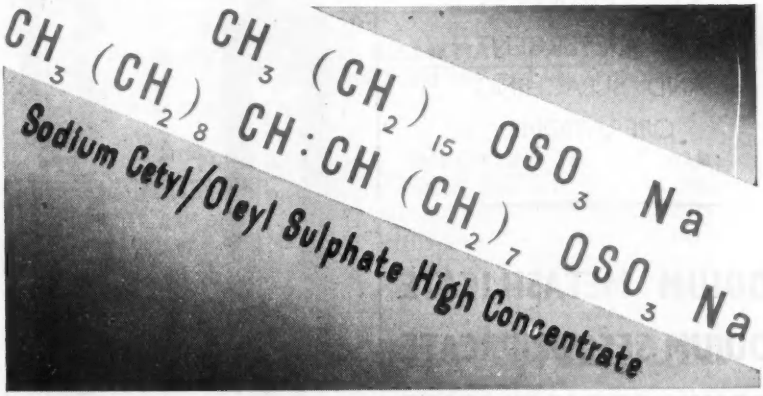

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The Chemist & Nature

THE contribution of chemists to agriculture and horticulture has always been a target for what might be called popular or subjective criticism. Even to-day there is a school of opinion that violently disputes the use of fertilisers as 'unnatural'. This type of criticism, fallaciously based upon a mystic worship of the organic world, is part of the warp of life and must be philosophically endured. It is more dangerous when it arises within the realm of science itself. While there must at all costs be free discussion in science and at no price can the modern device of 'party line' solidarity be imported, it is a matter for regret whenever one department of science appears to attack the advances of another. It is particularly so when in truth the two departments should be in harness. This impression was undoubtedly given in Dr. V. B. Wigglesworth's address last year to the British Association and it has been given again in his recent broadcast on the Third Programme. Intrinsically, Dr. Wigglesworth's thesis is a sound and vigorous plea for more attention to natural or biological methods of controlling pest insects. Unhappily, and unnecessarily, he bases much of his case upon the shortcomings and dangers of chemical insecticides.

No one will deny that modern synthetic insecticides are exceedingly powerful and that great care is needed in developing their use. Nor will any one deny that some applications of these materials have proved disappointing for both direct and indirect reasons. It must not be forgotten, however, that every new technical idea passes through an early phase of growing pains; indeed, it is as a result of youthful setbacks that most of the practical progress is made. The imperfections of modern insecticides are surely irrelevant evidence for natural methods of control. The case for biological methods of insect control must be based upon positive evidence for the effectiveness of this approach. The chemist's reply to entomological criticism could, indeed, be on the lines of the classic First World War retort about the 'better 'ole.'

Dr. Wigglesworth does not contend that the use of insecticides should be abandoned. On the contrary, he admitted that they were essential if unblemished produce was to be grown. But in his British Association address he said we should regard their use as an admission of failure, and in his broadcast talk he expressed the hope that biological methods could be developed so that in time chemical pressure could be relaxed. As an abstract theme this will command wide

support. Certainly most farmers and growers would agree with it. But practicable biological methods are not given to us any quicker by pointing out that in any case the chemical methods are not perfect. In a large number of the common and most wasteful types of pest attack, chemical methods of defence are the only ones we have. It is true that the regular use of DDT in orchards has been followed by severe increases in red spider and woolly aphis infestation. But is a natural method for controlling the blossom weevil, sucker, caterpillar, and capsid—the orchard pests that DDT does indeed control—within sight? The additional trouble of red spider and woolly aphis caused by DDT is a limitation upon this specific use of that chemical. It indicates that a more selective synthetic insecticide is required.

Dr. Wigglesworth referred to the hectic race to produce new chemical insecticides that had followed the discovery of DDT. Is such a development to be deplored? Is it not in fact the very means through which better chemical control with fewer shortcomings may be secured? In the choice between a biological and chemical approach, the 'vested interests' of the chemical producers were mentioned as a factor. It is a natural interest for a manufacturer, who has expended capital upon the development of a promising insecticidal material, to foster its use. This is perhaps a vested interest but the phrase to-day has a degraded atmosphere that is surely inapplicable to the British insecticide industry. This industry has worked closely with appropriate government departments, a system of approved formulations has been established, a considerable amount of field and laboratory research has been carried out and is steadily being expanded, and the principal companies have based their sales-policies upon technical realities. It is easy enough to criticise any product offered by this industry for the simple reason that the ideal insecticide for any task in pest control has yet to be discovered. But these products are being steadily improved—for example, the taint trouble of benzene hexachloride is being overcome by the introduction of the purer gamma-isomer form. The 'vested interest' is surely only indictable when progress is prevented, when technical possibilities of improvement are withheld from the consumer.

More research to seek biological methods of control is undoubtedly required. The past achievements of this approach provide a positive and more than adequate case for expansion. But, even if chemical control has had its failures and setbacks, the chemist's contribution towards insect restriction has been outstanding. Dr. Wigglesworth has indicated that a compromise is needed between the two methods. The very word suggests that there is a divergence between a purely chemical and a purely entomological approach. There is plenty of room for both.

On Other Pages

The annual subscription to THE CHEMICAL AGE is 30s. Single copies, 9d.; post paid, 1s.; SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3970). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham (Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited.

Notes & Comments

Science and the Public

TO 'diffuse information on every subject connected with useful arts' was the laudable object defined in the prospectus issued on 1 August, 1825, for *The Franklin Journal and Mechanics Magazine* under the patronage of the Franklin Institute of the State of Pennsylvania. How well that object has been achieved and maintained for 125 years, readers of the *Journal of the Franklin Institute*, as it is now called, can testify. The progress of science presupposes the unrestricted communication of all judgments and results, and the Franklin Institute was among the first to appreciate that in addition to the scientists and experts there existed a need to gratify the wants of the great mass of people who had no opportunity to receive a technical education, but who were keen to learn of any information on new tools and processes which were being developed for the enrichment of life. Intending contributors from the start were admonished that it was necessary 'to write in a style as familiar, and as little technical as the subject will admit.' There can be little doubt that in this wise decision the journal has, during its long and successful existence, played no small part in helping to popularise science in the U.S.A.

Antibiotic Progress

THE prospects and virtues of antibiotics do not lie entirely in the medical field. As trace nutrients for animals—so far chickens, turkeys, cats, rats, and pigs, have been tested—the antibiotics have been producing exceptional increases in rates of growth. Additions of 5, 10, and 100 parts per million to the diet have shown weight gains by the test animal of between 10 per cent and 30 per cent. In some American experiments the most stimulating antibiotic has been terramycin, obtained from soil moulds. In others it has been bacitracin, the antibiotic first isolated from the self-antiseptic fracture of a young girl's leg. All of the better-known antibiotics, however, stimulate the rate of growth of young animals. But minute additions to diet are all that is required; thus, in tests with pigs, less than one-third of an ounce was mixed into a ton of the basic feed. Animal feeding stuffs containing antibiotic additions will be commercially available in the United States during 1951. Messrs. U.S. Industrial Chemicals have already announced that a feed supplement containing bacitracin will be marketed. It is, of course, open to conjecture whether so new a finding of research should be put so speedily into general practice. There may be adverse consequences from growth stimulation by antibiotics which the tests have not so far had time to expose. Once again America's pioneering experiences will be of the greatest value to this country. As yet we probably have no antibiotic production to spare outside the primary medical field; by the time that we have sufficient production for new ventures, we should know whether the antibiotic supplements for animal feeding in the U.S.A. have been truly successful.

Anti-Malarial Measures

AN important question arose at the first African Malaria Conference convened by the World Health Organisation and the Commission for Technical Co-operation South of the Sahara. This was held in Kampala, Uganda, and was attended by 200 malaria experts representing 24 countries. A meeting afterwards, of the W.H.O. Expert Committee on malaria, considered how the recommendations of the conference could best be carried out in the African territories. It considered the results of experimental work in several countries, and the possible effects, in future, of DDT spraying. The question was put by His Excellency the Governor of Uganda in his opening

address as to whether large-scale anti-malarial measures should be undertaken in certain areas where malaria is endemic, in view of the danger of destroying acquired immunity. The Conference ultimately recommended that malaria should be controlled by modern methods whatever amount of endemicity might exist, since it would be possible to control any subsequent outbreak reasonably soon by the use of insecticides and anti-malarial drugs. The use of the anti-malarial drug Proguanil was recommended, since it has a low toxicity and it can be made available at a reasonable cost. The Conference took note of the fact that spectacular improvements in the productive capacity of agricultural workers and miners had taken place in South Africa, the Rhodesias, the Belgian Congo and Mauritius, wherever such anti-malarial measures had been carried out. At the same time it did draw attention to the danger of large-scale movements of ordinary or semi-immune populations to malarious areas.

Immunity or Drugs?

ANY observer who has spent a long time in the malarial regions of Africa, as the writer has done, will know that immunity is real enough, but it would appear sometimes a question of inherent immunity rather than a built-up one. The writer is one of those few Europeans who, though frequently suffering from bites of Anopheles, and irregularly dosing himself with quinine, had no conscious illness from malaria over a period of twenty years, during which time he lived in Uganda and Tanganyika. On the other hand many an African, born and living in malarious districts, fails to attain immunity and suffers from frequent attacks. It would seem, therefore, that the danger of losing immunity, if it is indeed inherent, is not so great unless, perhaps, there is loss of stamina on account of malnutrition. If the danger of losing immunity is a serious factor, and populations of regions might be subjected to re-infection from untreated country of the same continent, then the difficulty of distributing a drug to a scattered, primitive, and impecunious people should not be cast aside as of no account.

Glycerine's Price Climb

THE economic implications of glycerine synthesised from petroleum were discussed some seven months ago (THE CHEMICAL AGE, 12 August 1950, 1,622, 213-214). It was pointed out that glycerine prices had been unpredictable during much of the industrial history of this substance and this had discouraged earlier developments in the direction of synthetic production. In the past ten years, however, the demand for glycerine, always somewhat diverse in kind, had considerably enlarged owing to its increasing use as a raw material for plastics, cellophane, adhesives, and other modern organic synthetics. This had partly stabilised the market in peacetime and the large-scale development of synthesis had become economically possible. To-day the price is more than £230 per ton and in the international market glycerine is fetching a figure of £480 per ton. This might seem to favour the urgent development of synthetic glycerine production but from the long-term viewpoint so dramatic a price rise may in fact be detrimental. In the past price acrobatics have deterred potential users of glycerine from developing it as a raw material. It had, indeed, been hoped that the availability of synthetic glycerine would bring about price stability at an encouragingly low level so that a diversity of expanding uses of this material could be encouraged. The immediate prospects for synthesis are exceedingly bright; a more distant view of the market may well be cloudier. The prospects of glycerine, whether by-produced in the soap industry or synthesised at oil refineries, depend upon steady and sizeable peacetime uses. The current price will greatly damage those prospects. Where possible, users will try to find alternative materials.

Insect Resistance to DDT

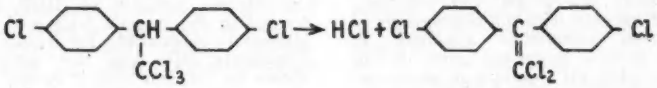
New Explanation of Toxic Effects

IF there are some survivors from repeated DDT treatments of colonies of an insect such as the housefly, then the progeny of these survivors are resistant to DDT and are apparently untroubled by doses that would be lethal to the normally susceptible fly. It has been fairly generally assumed that these resistant strains are, however, not resistant to insecticides other than DDT. Although they might show some resistance to Methoxychlor and similarly close analogues of DDT, they would not, for example, be resistant to Gammexane.

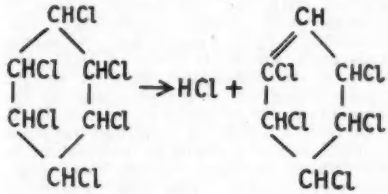
It has, in fact, been found in Denmark that after two years of treatment of cowsheds with DDT, a race of flies developed which were resistant to DDT but were susceptible to Gammexane, and Gammexane has been used to fight such flies, apparently with success.

The underlying implication has been that whatever the mechanism of the attack of DDT on the insect, it was *specific* to DDT and closely related compounds and was probably associated with the presence of some particular grouping or perhaps with the shape of the molecules. In any large community of flies there would be some individual specimens which for biochemical or morphological reasons were much less susceptible to the chemical or morphological action of DDT. Consequently, there would be some survivors after DDT treatment, and these survivors breed, reproducing in their own kind, a resistant strain.

Such a resistant strain would not, however, be expected to show resistance to an insecticide of a different chemical constitution and of a different molecular shape, and the success which has attended the use of Gammexane on DDT-resistant strains has supported this view. If, however, as has been suggested by Martin and Wain,[1] the toxicity of DDT was due to its ability to lose hydrogen chloride, so forming the ethylene derivative



then it was less easy to see why Gammexane, which could also lose hydrogen chloride,



should be able to attack insects which were resistant to DDT.

In fact, this ' loss of hydrogen chloride ' theory has not been particularly successful. Instances have been demonstrated of substances which could not easily lose hydrogen chloride having high toxicities, and the theory has not disturbed the general view that resistance to DDT on the part of a strain of fly was *specific* to that substance.

Recently, however, Pratt and Babers[2] have shown that a resistant strain of fly obtained by selective breeding from the survivors of repeated DDT treatments showed a considerable resistance to insecticides other than DDT, and this observation suggested that their resistance might simply have been due to increased vigour rather than to some specific biochemical defence.

A determined attempt to clear up the reason for the resistance of some individuals to DDT has just been reported by Winteringham, Loveday and Harrison,[3] of the Pest Infestation Laboratory at Slough. It is evident that chemical estimations of the very small amounts of DDT that are absorbed by flies would be very difficult and that estimations of the chemical substances to which the DDT is degraded in the fly's body would be almost impossible. Yet such information is required if an

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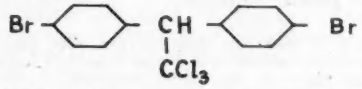
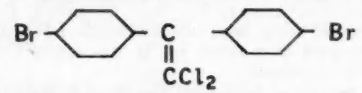
analysis of the process is to be made. The device has, however, been adopted at Slough of using di-(*p*-bromphenyl)-trichlorethane



labelled with the radioactive isotope of bromine with atomic weight 82. This compound has insecticidal properties apparently similar to those of DDT, and there is an assumption implicit in the research that its toxicity is due to the same fundamental cause as that of DDT.

In fact, a strain of houseflies resistant to DDT was also found to be resistant to the dibrom analogue. A big advantage, however, derives from the analytical standpoint, from the use of the labelled dibrom analogue of DDT, because microquantities of it can easily be detected by radiometric technique, *e.g.*, by the use of a suitable counter.

It was shown in control tests that the dibrom compound and its dehydrochlorination product, which has the constitution



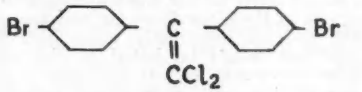
could both be detected and estimated to within about 5 per cent.

The first series of experiments were designed to answer the question 'Is the resistance of some individual flies due to their absorbing less insecticide than the majority?' Trials were carried out with individuals from both DDT-susceptible and DDT-resistant strains of housefly; an acetonical solution of the dibrom insecticide was painted on the dorsal surface of the thorax of the fly. The insects had, for the purpose of the test, been lightly anaesthetised with cyclopropane. When 2 micrograms of insecticide were applied to each fly, about 40 per cent of it was absorbed in 24 hours, irrespective of the strain from which the fly came. The remaining unabsorbed portion was easily removed by a brief rinse in acetone. Clearly, the resistance of some individuals was not due to their inability to absorb the insecticide.

Flies, both susceptible and resistant, were next injected with 0.6 micrograms of the dibrom insecticide dissolved in acetone. After 24 hours the group of flies were macerated with sodium sulphate and dilute sulphuric acid and the macerate extracted with ether. The extract was examined with the following results:

Susceptible Flies: Extract contained only the unchanged dibrom insecticide; this was recovered in about 95 per cent. There was no evidence that it had undergone any chemical change in the body of the living fly.

Resistant Flies: The extract contained the ethylene derivative



in quantity equal to 57 per cent of the original dibrom insecticide. Some of the original dibrom compound was also isolated, so that in all about 95 per cent of the original dose was recovered in one form or another.

Clearly therefore the resistant flies possessed the ability of dehydrochlorinating the dibrom insecticide which had been injected into them, whereas the susceptible flies had been unable to change it chemically. Here was a significant difference of no mean order—perhaps the most fundamental discovery that has yet been made on the mechanism of the attack of these insecticides. But the question immediately arose as to whether a similar difference in behaviour between susceptible and resistant flies existed when the insecticide was applied to the exterior surface of the fly instead of being injected.

In order to answer this last question, an experiment was made in which a very large dose (50 micrograms) was applied to the surface of each of a group of resistant flies. After 24 hours it was found that 8.7 per cent of the insecticide had been dehydrochlorinated. Evidently in the case of contact, as well as injection, the resistant flies are able to convert the insecticide to the ethylene derivative, which is only mildly toxic. Apparently, therefore, the resistant strains bred from survivors of DDT treatments possess the power of changing the DDT chemically in their bodies and it was the possession of this unusual accomplishment which enabled their ancestors to survive the DDT treatment.

An interesting and important corollary to the observations is that DDT itself is the agent which paralyses the insect's nervous system and which kills it. It has sometimes been suggested that it is a degradation product of DDT which is formed in the insect's body and which is ultimately responsible for its death. How completely false was this suggestion is shown by the fact that it is only in those flies which are resistant to the effect of DDT, that the DDT undergoes any chemical change; in those normal flies which are

killed by DDT, the DDT undergoes no chemical change.

When it was clear that the resistant strains of fly owed their immunity to their ability to change the DDT, or, more properly, its dibrom analogue, into an ethylene derivative, the next question to answer was as to whether this ability was a property peculiar to the live fly. For example, would the bodies of dead flies which were of a resistant strain also change the dibrom insecticide into the corresponding ethylene derivative. Two series of experiments were made:

(1) Resistant flies were killed by immersion in water at 90° C. for 1 minute, before being injected. After 24 hours they were macerated and the macerate extracted. Only unchanged dibrom insecticide was found; none of the ethylene derivative was found.

(2) Resistant flies were disintegrated in a pestle and mortar before adding the insecticide. After 24 hours they were extracted and the extract was found to contain only unchanged dibrom insecticide; it contained none of the ethylene derivative.

It is thus evident that the ability to change the insecticide chemically is a property of the living resistant fly and is not shared by the dead resistant fly.

Effect of Pyrethrin Synergist

In another experiment the injected solution of dibrom insecticide contained also some of the pyrethrin synergist, piperonyl cyclonene, at the rate of 1 per cent wt/vol. of solution. Its presence 'appeared completely to inhibit the metabolic dehydrohalogenation' *i.e.*, it prevented the resistant flies from exercising their usual function of changing the insecticide into the relatively harmless ethylene derivative.

Three important facts are gained from this research:

1. The resistance of strains of houseflies which have been bred from survivors of repeated DDT treatments is not due to different absorption of the insecticide; resistant flies, in fact, absorb as much insecticide and at the same speed as do susceptible flies.

2. The resistant flies possess the power of changing the insecticide into the much less harmful ethylene derivative. It should however be noted that the rate of change is slow, only just over one-half of the insecticide is changed in a day.

3. The ability of live resistant flies to dehydrochlorinate DDT (or its dibrom analogue) is not shared by their dead bodies.

Furthermore, these discoveries should finally eliminate the theory that the toxicity of DDT and of other insecticides is due to ability to split off hydrogen chloride in the body of the insect, and that it is this hydrogen chloride which is the real toxic agent. The facts point in exactly the opposite direction. It is precisely those insects (of the resistant strains) which are *not* killed by DDT, which do split off hydrogen chloride from the insecticide molecule and by so doing convert the DDT into the much less harmful ethylene derivative, and thereby the resistant insects save themselves.

Winteringham *et al* suggest that the chemical change which takes place in the body of the resistant insect, *i.e.*, the change whereby the insecticide is dehydrochlorinated, is enzymic in nature, but that the enzyme system is either destroyed or made inaccessible when the insect is killed. It is puzzling that such a slow rate of change of the insecticide (only half of it changed after 24 hours) should be sufficient to save the insect, which would have been expected to perish long before any appreciable quantity of the insecticide had undergone any chemical change. Even allowing for the fact that the metabolic rate is faster to begin with and slows down markedly after 5 hours, it is still difficult to see why the insect should not have suffered lethal injury in the first few hours. It is suggested that perhaps 'only a small fraction of the applied insecticide is involved at the site of action; but it is this fraction which is metabolised.'

The possibility that the presence of some of the ethylene derivative had an antidotal effect on the dibrom-insecticide so that as soon as some of the ethylene derivative (dehydrochlorination product) had been formed the animal was safe, was contemplated. A trial in which mixtures of the dibrom insecticide and of its dehydrochlorination product were injected into susceptible flies had the usual lethal effect: there was no evidence that the ethylene derivative exerted any protective action.

While it cannot be said that this new work offers a complete explanation of the toxic mechanism of DDT, it must be agreed that it advances very considerably our understanding of the action of modern highly chlorinated insecticides and throws new light on the properties of resistant strains of houseflies. Finally, it affords an outstanding example of the beneficial results accruing from the application of radio-tracer technique to biological research.

REFERENCES.

[1] H. Martin and R. L. Wain, *Nature*, 1944, *154*, 512.
[2] J. J. Pratt and F. H. Babers, *Science*, 1950, *112*, 141.
[3] F. P. W. Winteringham, P. M. Loveday and A. Harrison, *Nature*, 1951, *167*, 106-7.

Monsanto to Make Study

Accept A.E.C. Invitation

IN reply to the invitation put forth recently in America by the Atomic Energy Commission offering to open its secret nuclear reactor programme for study by private industry wanting to develop electric power from atomic energy, the Monsanto Chemical Company has announced that it is ready to go ahead with a study of the feasibility of developing and operating nuclear reactors. Although the primary objective of privately-operated nuclear reactors would be the production of electric power, such reactors would also produce plutonium, presumably for delivery to the Atomic Energy Commission. In a letter to Dr. Henry D. Smyth, an atomic energy commissioner, and author of the famous Smyth Report, Dr. Charles Allen Thomas, executive vice-president of Monsanto, said that his company is willing to pay for the study of a possible programme to develop privately owned and operated atomic piles, and is prepared to send a group of ten to fifteen qualified engineers to be trained by A.E.C. experts in the atomic pile field. Dr. Thomas, last year, was one of the originators of the plan for private development of atomic energy.

Objectives Enumerated

In announcing its willingness to undertake the research, Monsanto said its study would have the following objectives:

1. Determine if sufficient materials and information exist to permit the design and construction of a nuclear reactor producing electric power and plutonium, the basic atomic bomb fuel;

2. Determine if such an atomic furnace could make plutonium at a cost equal to or less than present costs and at the same time make electricity economically if the plutonium were bought by the government;

3. Recommend any additional research and development work required for the design of a power reactor; and

4. Set up the basic design premises for a power reactor producing plutonium.

Dr. Thomas did not elaborate on steps to be taken following conclusion of the study—the design, development, construction and operation of a reactor—primarily because in announcing its invitation to private industry the A.E.C. indicated quite clearly that it is not yet ready to go into those details.

At the conclusion of the basic study, the Monsanto engineers would submit a report on its study to the A.E.C. which would be subject to distributing solely at the discretion of the commission. The Monsanto engineers would be subject to the same security regulations that now apply to A.E.C. personnel. It is believed that the Monsanto offer will be accepted by the Commission.

Japanese Firm Formed

THE president of the B. F. Goodrich Chemical Company, Cleveland, Ohio, W. S. Richardson, has announced that arrangements have been concluded between several large Japanese industrial firms and the Goodrich chemical company for a newly-formed company, Japanese Geon Company, Ltd., to construct facilities in Japan for the manufacture of Geon polyvinyl chloride.

According to Mr. Richardson, formation of the new company has been approved by the Japanese Foreign Investment Commission and SCAP (Supreme Command Allied Powers), and construction of the new plant will begin in the immediate future. Engineering design of the new plant and manufacturing techniques will all be furnished by the B. F. Goodrich Chemical Company, a principal owner of the new Japanese company.

Geon polyvinyl chloride is the main ingredient in the manufacture of many plastic products.

In addition to B. F. Goodrich Chemical Company, principal stockholders in the Japanese firm are three important Japanese corporations:- The Furukawa Electric Company, Ltd., Nippon Light Metal Company, Ltd., and the Yokohama Rubber Company, Ltd., all of Tokyo.

Mr. Richardson said 'We believe that the manufacture of Geon polyvinyl chloride in Japan from indigenous raw materials will be a constructive step toward the necessary revitalisation of the Japanese economy. The proven versatility of Geon polyvinyl chloride in this country and abroad, both in peace and wartime, will now be available to Japanese industries in their re-building effort.'

The new polyvinyl chloride plant, to be located at Kambara, approximately 65 miles from Tokyo on Suruga Bay, will be staffed completely by Japanese. Engineers from the B. F. Goodrich Chemical Company will leave shortly for Tokyo to direct construction and initial operations of the new company.

The Empirical Flow Test

Colour Chemists Hear Lecture on Printing Ink Technology

THE editor of the Oil and Colour Chemists' Association's *Journal*, Dr. R. F. Bowles, addressed a meeting of the London Section of the Association on Thursday, 8 February, on "The Empirical Flow Test in Printing Ink Technology." Mr. Leslie O. Kekwick, the chairman of the Section, presided.

The principle, the method of operation and the very respectable parentage of the empirical flow test having been given in a previous paper he had presented, Dr. Bowles gave the reminder that that experimental method had been devised to record numerically or graphically the development of rigidity in a material from an initially known and reproducible state of disorder. One practical point needed to be added to the previous account; it had been pointed out by G. W. Spiers that by using a massive steel cylinder the temperature could be controlled in an unregulated atmosphere by heating the rotating cylinder in a small gas flame until the required temperature of operation was reached.

The main purpose of the paper was to present some examples of the use of the empirical flow test in the observation of the rheological behaviour of various classes of printing inks and to show how that had been in some cases correlated with observations made in industrial practice.

Dr. Bowles did discuss the theory, however, as developed by various workers in that field. But he added that some theoretical conceptions, while interesting, were not general enough for the present work. It might well be that the subject of rheology had reached a stage where a radically new theoretical approach was necessary; but certainly it was a fact that modern mathematical treatments were outside the scope of the average technologist in industry, and from that point of view, if not from any other, the empirical approach was definitely to be preferred.

Determined Empirically

The conditions of the test were all determined empirically in relation to the rheological picture required for a specific purpose.

Coming to applications of the test in printing ink technology, Dr. Bowles showed a sectional view of the ink in the duct of a typical letterpress or offset printing machine. The ink was contained in a trough, one side of which consisted of a flexible steel blade, the other side being a steel roller. The roller rotated a fraction of a revolution for each print that was made, and in doing so it drew through the gap between it and the steel blade a film of ink. The film so removed from the duct might be 20 microns thick and upwards of 1 cm. wide; the main bulk of the ink in the duct, therefore, was under fairly static conditions and was subjected in bulk to but small stresses. The successful operation of the printing machine, on the other hand, depended entirely on the extrusion of that thin uniform film of ink. One would expect that the interfacial characteristics of the ink and the metal of the machine would have a bearing on the distribution of the ink, but in practice that was not found to be so. Most inks had to be fairly soft in consistency for distribution in that way, and the interfacial tensions of such materials appeared to vary little when measured by orthodox methods. Nevertheless, it might be found ultimately that we had been measuring the wrong property.

Characteristic Profiles

Discussing the appearance of ink in the duct, he said there were two characteristic profiles. Inks having a low yield value and low viscosity behaved more or less as Newtonian fluids and they levelled out in the duct. Inks having high viscosities and high yield values did not level out because the rate of shear applied was insufficient to overcome the rigidity in the ink; they exhibited a circular profile in the duct.

The third case was that of inks having insufficient cohesion to act as one mass under the shear in the duct, and too high a yield value to behave as fluid systems; in consequence, the action of the duct roller liquefied a portion only of the total ink, which was then distributed over the machine. After that had been used, unless the remaining ink was agitated either manually or mechanically, the ink ceased to emerge from the duct and the machine ceased to print. That annoying phenomenon was known as "hanging back" in the duct and was a source of anxiety when endeavouring to print flat solids in which

the use of a low viscosity highly pigmented ink was desirable. The empirical flow test map enabled that condition to be avoided; it could be corrected by increasing viscosity or decreasing yield value, and in most cases one or other treatment was applied.

Superstition Investigated

By "coverage" of ink the printer implied the area of paper it was possible to cover with unit weight of ink printed in the minimum film thickness to give a continuous film—a solid print. The amount of ink arriving on the rollers of a printing machine was determined by the angular rotation of the duct roller which occurred after every impression; that was controlled by the pawl and ratchet device attached to one end of the duct roller. There was a superstition among printers that the coverage of an ink was inversely proportional to the number of ratchet teeth necessary to obtain a solid print of minimum thickness. It was important to investigate the matter, for good inks were frequently rejected by applying that criterion, and inks having a satisfactory duct action from that point of view were sometimes adopted without reference to their other possible disadvantages.

The original experiments of that investigation were done in 1936, and had taken the form of printing a variety of inks, each having the same intrinsic colour strength, but different behaviour in the duct. Dr. Bowles gave details of the method adopted, whereby a production machine could be used to give results of scientific value. The colour strength of the prints was determined visually by the printer, and the accuracy of judgment of a skilled operator was shown by the fact that, of 25 printing tests, the calculated film thickness on the paper did not vary more than 9 per cent from the arithmetic mean, and was most frequently within ±5 per cent.

It was shown then that there was no correlation between the coverage of those inks and the number of ratchet teeth necessary on the duct, but it was not clear what factors were determining the behaviour of the ink.

Some years later, after the empirical flow test had been developed, the data were re-examined in conjunction with the empirical flow test curves of some of the inks involved. It became evident that there was some correlation between the number of teeth and the low shear flow characteristics of the inks. Much searching had failed to reveal any other physical properties of the inks which influenced the behaviour in the duct, and there was no evidence whatever that the coverage depended upon that property.

To maintain distribution of the ink on the machine it was obvious that a considerable degree of fluidity was necessary, and that if the ink should exhibit the rheological properties of a solid, then distribution would cease. In fact, poor distribution invariably occurred through the intrusion of the phenomenon of dilatancy—the name given to the rheological state where stress increased the strain. It was usually associated in inks with good wetting, a high degree of pigmentation and a high viscosity of the continuous phase. It was observable at high rates of shear, the ink clogging up on the rollers near the duct and refusing to feed forward satisfactorily on to the printing surface. Hence, said Dr. Bowles, we observed the paradoxical condition of an ink having too much pigment, yet in the finished print appearing to be deficient in pigment. The various methods of treating poor distribution were obvious, as was also the fact that inks for high-speed machines must be less liable to dilatancy than inks for slow machines.

Dilatancy at low rates of shear could be detected in the empirical flow test curve. The technique, however, was not really suitable for dilatant systems as the rate of shear used was generally too low, and, particularly if the viscosity of the continuous phase were too high, the curve could not be analysed in its two sections. In consequence of the type of materials exhibiting dilatancy, the phenomenon was probably synonymous with non-laminar flow, the onset of which was more easily observed by using a co-axial cylinder viscometer with a gradually increasing rate of shear.

Viscosity and Tack

With regard to viscosity and tack, he said, the conditions at the transition from predominantly fluid flow to a predominantly static condition could be read off from the E.F.T. curve as a time and a "yield value." That yield value was not generally of importance in the distribution of inks on offset and flat bed letterpress machines, but it was of importance with news inks, which might lie stagnant in pipelines; the development of thixotropy under such conditions might give rise to a great deal of trouble in getting the ink to flow again after a period of rest. Tack or viscosity of ink was important to the printer. For example, the tendency to "picking" or "plucking"—where a tacky ink running at a high speed

might pull small pieces of the paper surface away from the rest of the sheet—was always associated with high viscosity, coupled with a high speed of the machine, and again could be detected by the shape of the E.F.T. curve.

With experience it was found possible to construct an ideal E.F.T. curve incorporating the various rheological desiderata for specific inks, or specific classes of inks. Such a curve or an area could be used as a rheological specification and was invaluable for maintaining consistency control from batch to batch, and for formulating inks with alternative materials.

Coming to milling, he said the incorporation of pigment into vehicle in conventional plant involved a number of fairly well-defined stages which were easily differentiated by E.F.T. curves. Dr. Bowles set out the sequence of physical changes and said the Hegeman-type grinding gauge and the empirical flow test could both be used for recording observations of that sequence of phases during the processing of an ink. A recent study of the use of the Hegeman gauge in a typical deflocculatory paint system had been made by Baker and Vozzella, who had correlated the gauge readings with particle size, demonstrating the gradual reduction of the latter Bernstein, on the other hand, using inks, had shown how, in what were probably flocculatory systems, large particles of 'ampactoids' were built up by milling. In the former system, the more one ground the material the finer or silkier it became. In flocculatory systems, grinding increased thixotropy or shortness, and in some cases it was possible to observe the ink becoming rougher by the growth of the imparted flocs. Those changes could be followed equally well by empirical flow tests.

Variations in Grinding

News inks, being flocculatory systems, reacted in the anticipated manner to variations in grinding. Variations were shown up as differences in consistency throughout a batch. Dr. Bowles illustrated a family of E.F.T. curves taken throughout the grinding of a 4-ton batch of news ink. It was remarkable that the low shear flow was almost constant and that the variation in mechanical treatment throughout the batch had resulted solely in variations of yield value. It was demonstrated in subsequent batches of the same ink that the differences in consistency shown could be produced by adjustment of the pressure on the mill roll.

Thus it was shown to be possible to demonstrate variations in grinding technique by means of E.F.T. curves, Some attempt was made to place that aspect of the matter on a more quantitative basis by endeavouring to relate the output of the mill to the roll pressures. The correlation coefficient of those results was not sufficiently high to warrant drawing any definite conclusions from those experiments, but Dr. Bowles felt that if a greater measure of control could have been introduced, some relationship might have been found.

The E.F.T. apparatus could be used as a viscometer for high viscosity materials. In view of the plethora of viscometers available, there was no point in trying to use a new instrument in places where other instruments would do equally well or better. However, some materials behaved as very high viscosity Newtonian fluids at low rates of shear and could not be sheared at high rates, and for those the E.F.T. technique was invaluable.

Important Application

An important application of the technique was in the investigation of the consistency of semi-gelled materials, such as heavily bodied stand oils or strong litho varnishes, oxidised oils, alkyd resins, rubber dispersions and, in fact, most lyogels.

The 'viscosity' of such products was easily ascertained by the E.F.T. technique, but the instrument had to be filled with the minimum mechanical disturbance of the sample and, of course, no preliminary mechanical deflocculation must take place. Under those conditions E.F.T. curves fairly near to straight lines were obtained from which 'viscosities' in poises could be calculated for record purposes. Strong litho varnishes, for instance, yielded viscosities of 300 to 1,500 poises at 25°C., and provided sufficient time had elapsed after manufacture for the material to reach an equilibrium condition, the data were reproducible and correlated well with subjective assessments of consistency.

Summing up, Dr. Bowles said that in ink technology the empirical flow test was a unique method for recording behaviour of ink in the duct, ease of distribution, estimation of tack, efficiency of grinding, bath control of consistency, and the viscosity check of strong litho varnishes and similar lyogels.

During the discussion which followed Mr. Hawkey referred to inks taking up water, and asked whether that resulted in changes of the E.F.T. curves.

Dr. Bowles said the absorption of water

was very important in offset. The inks gave a normal flow curve if the water absorbed remained within the definite limit in which the ink was quite fluid. If an ink continuously absorbed water, the point was reached at which the thixotropy began to increase very markedly, so that one obtained a series of curves which varied from the normal flow curve; and at some point, which could be determined only by experiment for any given conditions, the ink absorbed so much water that it would not distribute, i.e., it no longer acted as a fluid on the machine, in his opinion, in nearly all cases, particularly with offsets, where there was a 'pale' result it arose from the introduction of excessive dilatancy due to the absorption of water preventing the distribution of the ink across the machine.

The Factor of Speed

Mr. Southworth asked if the speed of the printing machine had a great bearing on the consistency.

Dr. Bowles replied that it did. An ink, in order to be distributed, must behave more or less as a fluid—it must be more fluid than solid—and if the rate of shear operating on the machine were such that dilatancy intervened, then the ink could not be distributed. Thus, as the speed of the machine increased, the ink must be made more fluid in order to withstand the extra rate of shear involved.

Replying to a further question by Mr. Southworth, he appreciated that no two printers used their inks in the same way and said the problem of ink consistency was difficult mainly because the results depended to such an extent on the temperature, which should be kept constant. Apart from that, there were a number of instruments which could be made in any decent workshop for a few pounds and which would record the consistency of ink, but there was no reliable apparatus about which particulars had yet been published to give a single figure for the consistency of ink that meant anything.

Of all the instruments he considered that the E.F.T. apparatus was as ample as any and he could see no reason why it should not be used widely by printers for recording the condition of the ink as it was used.

Accepting the view that printers would insist on 'doctoring' their inks, he said the printing ink maker could only undertake to supply a printer with ink which he found acceptable and ensure that each batch supplied was of the same standard.

Mr. Matthews, referring to tack, asked how the inkometer reading would marry up with the reading obtained in the viscometer.

Dr. Bowles replied that inkometer readings were a mixture of viscosity and possibly surface tension and a number of other things, mixed up in such a way that there was nothing regular in those readings. A number of people had tried to obtain some correlation between inkometer readings and other means of measuring consistency, but they had failed.

Mr. R. F. G. Holness asked if Dr. Bowles had any idea of the maximum shearing stress most useful in practice.

Dr. Bowles replied that the maximum shearing stress that he used was 350 reciprocal seconds. That was determined in the first place quite empirically, by taking a large number of inks and finding out the highest rate of shear which the stiffest inks normally used would stand.

Dr. R. Leach congratulated Dr. Bowles on having been able to tie up the rheological properties of inks with such problems as grinding, milling, distribution, and so on.

Mr. Holness, proposing the thanks of the meeting to Dr. Bowles, said he had discussed the extension of the work described in his 1948 paper, which was entitled 'A Coaxial Cylinder Viscometer of Wide Utility.' One did not suppose that any who had read that earlier paper had suspected then that the method would have proved of such utility.

Not Synonymous

With regard to the point that tack was defined largely by viscosity. Mr. Holness said he agreed if that tack were determined at low rates of shear; but he had very considerable doubts as to whether it was synonymous with viscosity at very high rates.

In connection with news inks Dr. Bowles had illustrated a whole family of curves showing the increase in yield value with increase of grinding. Probably the explanation was that increased grinding separated the individual particles more and that it was the smaller particles which ultimately flocculated to give a much stronger gel than would be the case if the grinding were not increased; so that it was not a case of the building up of 'impactoids' which had been described by Bernstein.

Finally, Mr. Holness said it seemed that Dr. Bowles was as much a physicist as any printing ink chemist, and much more than most, and he suggested that what had been stated in the paper should be highly provocative to the makers of paint.

Reduced Stocks of Non-Ferrous Metals

Considerable Rise in Consumption

STOCKS of non-ferrous metals at the end of December 1950, with the exception of lead and slab zinc (all grades), were at a much lower level than at the close of the same month of 1949.

Details from the summary issued by the British Bureau of Non-Ferrous Metal Statistics showed the following comparisons of stocks (in long tons): Blister copper 31,370 (46,796); refined copper 72,960 (82,878); zinc in concentrates 44,025 (37,026); and slab zinc 36,256 tons (61,570).

While production varied slightly, there was, on the whole, an increase in consumption in most items.

Exports of tin, although higher than in December 1949, were again marked by a reduction, being 594 long tons compared with 871 long tons in November 1950. Imports, on the other hand, were 1,025 long tons in December 1950, as against 510 long tons in the previous month.

UNWROUGHT COPPER

	Long Tons	
	Blister Copper	Refine Copper
OPENING STOCKS:		
Govt. and consumers'	30,351	73,033
Imports	12,221	16,737
PRODUCTION:		
Primary	—	12,239
Secondary	911*	4,762
CONSUMPTION:		
Primary	12,355	28,931
Secondary	—	15,029
Exports	929†	18
CLOSING STOCKS:		
Govt. and consumers'	31,370	72,960

* Rough copper.

† Includes 391 tons of rough copper despatched to Belgium and 538 tons of rough copper to Germany for refining on toll.

GROSS OUTPUT OF MAIN COPPER ALLOY, AND PRODUCTS

Unalloyed copper products	25,767 long tons
Alloyed copper products	25,533 ,, ,,
Copper sulphate	4,086 ,, ,,

UNWROUGHT ZINC

	Long Tons	
	Zinc in Concentrates (estimated gross Zinc content)	Slab Zinc (all grades)
OPENING STOCKS:		
Govt. and consumers'	48,548	37,308
Imports	4,678	8,028
PRODUCTION:		
Virgin and remelted	3	6,422
CONSUMPTION:		
Virgin (incl. debased)	9,204	16,843
Remelted and scrap	—	7,495*
Exports and re-export	—	5
CLOSING STOCKS:		
Govt. and consumers'	44,025	36,256

* Includes a small quantity of zinc concentrates consumed directly for chemicals, etc., which is also included as consumption of concentrates.

LEAD

	Long Tons			
	Lead in Concentrates	Imported Virgin Lead	English Refined	Lead Content of secondary Scrap and Residues
OPENING STOCKS:				
Govt. and consumers'	—	56,874	8,228	—
Other stocks ...	69	—	—	—
IMPORTS	—	11,570	—	105
PRODUCTION	260	—	4,289	—
CONSUMPTION ...	266	13,803	4,998	7,594
EXPORTS AND RE-EXPORTS	—	70	—	—
CLOSING STOCKS:				
Govt. and consumers'	—	54,168	7,519	—
Other stocks ...	63	—	—	—

TIN METAL

	Long Tons
GOVT. AND CONSUMERS' STOCKS (at end of period)	8,751
IMPORTS	1,025
PRODUCTION	—
CONSUMPTION	1,709
EXPORTS AND RE-EXPORTS	594*

* Exports total 594 tons, of which to U.S.A., 221; S. America, 75: Denmark, 60: Norway, 44; Canada, 40; Netherlands, 35; Germany, 32.

ANTIMONY

	Long Tons
TOTAL CONSUMPTION OF ANTIMONY METAL AND COMPOUNDS	430
TOTAL CONSUMPTION OF ANTIMONY IN SCRAP	295

CADMIUM

	Long Tons
TOTAL CONSUMPTION OF CADMIUM ...	32.20

Borax and Boric Acid Prices

STABILITY of borax and boric acid prices was one of the features of the chemical markets during 1950.

Due, however, to increased costs at its mines, higher dock charges and ocean freights on raw materials, increases in delivery charges, and higher wages at its refineries, Borax Consolidated, Ltd., announce a rise in its prices as from 21 March next.

Borax (ordinary decahydrate) and Neobar (pentahydrate) will be increased by £2 10s. a ton; Dehybor (anhydrous borax) by £3 10s., and boric acid by £4.

Up to and including 10 March, deliveries will be invoiced at current prices, to contractors on the basis of proportionate monthly quantities and to other regular customers in quantities not exceeding one-sixth of total deliveries made in the six months April to September, 1950, inclusive.

The Australian Chemical Industry

By F. H. CAMPBELL, D.Sc., F.A.C.I. Chemical Adviser,
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DURING the latter part of the 19th century it was generally accepted by Australians as natural that the only exports were the products of primary industries—wool, tallow, hides, wheat—and of mining gold, silver and base metal ores. These paid for manufactured goods and certain raw or part manufactured materials, such as pig iron, which was often used as ballast for outward bound ships.

Under such conditions only those secondary industries which could find markets for their products among agriculturalists, graziers and mining companies could establish themselves.

Few Chemicals

There were at that time only a few primary industries which required chemicals in quantity. Those being made were sulphuric acid, super-phosphate and, towards the end of the period, industrial explosives. As demand increased hydrochloric and nitric acids were added, as were ammonia and ammonium sulphate from gas works. On the organic side the production of ethanol from molasses was equal to the demand for industrial spirit.

During the first decade of this century no great development occurred, pure analytical chemicals were almost entirely of German origin, as were chemical glassware and instruments.

Chemicals continued to be imported during world war I although the output of nitroglycerine, nitrocellulose and of acetone required for the manufacture of cordite underwent rapid expansion. The development which had the most widespread long-term influence was the establishment in 1916 of a plant for the recovery of benzene and toluene from coke oven gas.

Gradual expansion of secondary industries of many kinds between the wars enabled manufacturers of chemicals to extend their range, but apart from the establishment of Imperial Chemical Industries of Australia & New Zealand, Ltd., which occurred towards the end of the period, the outstanding step forward was the success which attended the investigation into the production of nitration cellulose from locally grown softwood.

At the outbreak of world war II the situation was less favourable in that imports were more difficult to secure, and more favourable in that Australia had men with experience gained in the United Kingdom and the vision to plan ahead, together with an abundance of chemists, many with overseas experience, to whom subsidiary tasks in planning new factories could be entrusted.

In addition, several substantial corporations had come into existence and the co-operation of their leaders with the Directorate of Materials Supply and the Medical Equipment Control Committee, and to a lesser extent with the Department of War Organisation of Industry, was invaluable.

The Controller of the Department of Defence arranged for the erection of annexes to existing chemical factories for the production of such wartime essentials as aniline, activated carbon, military smokes, nitric acid from synthetic ammonia, and ammonium nitrate.

First Results

By the beginning of 1943, the preparations made during the two preceding years began to show results. The first synthetic ammonia and methanol plants had been joined by four more, and a Solway alkali plant came into production, but the necessary priority given to materials essential to the prosecution of war and the shortage of labour and materials kept the number of chemicals manufactured in Australia from any marked increase during the last stages of the war.

On the cessation of hostilities the Directorate of Materials Supply, the Medical Equipment Control Committee and the Department of War Organisation of Industry went out of existence. Certain of their records and functions were taken over by the Secondary Industries Commission, and later passed to the Division of Industrial Development, a section of the Ministry for Post-War Reconstruction. This division rapidly accumulated a mass of information regarding the chemical industry, and it was decided to make as much of it as possible available to the public.

This was achieved by the publication of a Directory of Australian Chemicals at the end of 1948 a second edition of which is on sale in London at the present time.

Basic Chemicals in November

DESPITE an improved production of some basic chemicals and non-ferrous metals in November, 1950, increased consumption in a number of cases caused a reduction of stocks.

Details revealed in the current issue of the *Monthly Digest of Statistics*, No. 61, 1951 (HMSO, 2s. 6d.) included the following fluctuations (in thousands of tons) compared with the same month of 1949. Consumption: Sulphur 28.9 (27.0); molasses (distilling only) 52.2 (22.3); pyrites 16.6 (18.7); compound fertiliser 84.7 (111.9); liming materials 600.7 (710.0); phosphate rock 69.7 (93.3).

Among the non-ferrous metals consumption increased in copper, zinc, zinc concentrates, and tin with a corresponding decline of stocks in each case. Lead, however, was an exception with improved production and stocks.

Estimated numbers employed in all sections of the chemical and allied trades in November, 1950, were again marked by an increase, the total (in thousands) being 456.2, compared with 455.1 in the previous month of last year, and 445.4 in November, 1949. Distribution of workers was: coke ovens, chemicals and dyes, explosives, etc., 262.4 (193.6 men, 68.8 women); pharmaceuticals, toilet preparations, etc., 86.4 (43.7 men, 42.7 women); paint and varnish 39.2 (27.8 men, 11.4 women); mineral oil refining, other oils, greases, glue, etc., 68.2 (54.7 men, 13.5 women).

	November, 1950			November, 1949		
	Production	Consumption	Stocks	Production	Consumption	Stocks
Sulphuric acid	147.0	148.0	—	140.0	148.0	—
Sulphur	—	28.9	85.3	—	27.0	87.6
Pyrites	—	16.6	73.3	—	18.7	68.3
Spent oxide	—	16.3	194.9	—	15.7	178.4
Molasses (cane and beet)	53.7	52.2*	164.9	58.1	22.3*	260.7
Industrial alcohol (mil. bulk gal.)	3.33	3.32	0.59	1.60	2.46	2.40
Ammonia	—	7.46	10.01	—	6.82	5.73
Superphosphate	12.9	16.5	—	19.3	17.2	—
Compound fetiliser	148.3	84.7	—	161.5	111.9	—
Liming materials	—	600.7	—	—	710.0	—
Nitrogen content of nitrogenous fertilisers	21.92	18.53	—	20.65	19.36	—
Phosphate rock	—	69.7	322.9	—	93.3	203.4
Virgin aluminium	2.53†	17.3†	—	2.24†	15.2†	—
Virgin copper	—	36.3	103.4	—	28.7	136.6
Virgin zinc	5.24	20.8	37.3	4.8	19.6	64.2
Refined lead	6.71	15.3	65.1	2.44	15.7	55.2
Tin	2.20†	3.11†	7.9†	2.01†	2.38†	15.4†
Zinc concentrates	—	14.5	100.0	—	11.3	72.0
Magnesium	0.51†	0.62†	—	0.46†	0.3†	—
Pig iron	193.0‡	158.0‡	493.0‡	187.0‡	141.0‡	495.0‡
Steel ingots and castings (including alloys)	336.0‡	—	1,060.0‡	315.0‡	—	1,246.0‡
Rubber: Reclaimed	0.75	0.79	2.43	0.51	0.59	2.33
Natural (including latex)	—	6.09	39.4	—	4.76	41.9
Synthetic	—	0.06	0.72	—	0.05	1.22

* Distilling only. † October. ‡ October.

Chilean Nitrate Merger Announced

AGREEMENT has been reached between the boards of Lautaro Nitrate and the Anglo-Chilean Nitrate Corporation as to the main terms of the proposed merger of the two companies.

The terms are, of course, subject to the approval of the companies' security holders. In addition, sanction by Court order in England as part of a scheme of arrangement of Lautaro under the Companies' Act will have to be obtained.

Anglo-Chilean is to assume all the obligations of Lautaro, including its two outstanding issues of Sterling debenture stock and its outstanding issue of U.S. Dollar Bonds.

Certain properties used in connection with the solar evaporation process of the companies, which now form part of the security for the two issues of debenture stock and in small part on a junior basis for the issue of U.S. Dollar Bonds, to be released from the liens of these three issues.

Unrestricted Imports

Additions to Open General Licence List

ADDITIONS and amendments to the list of goods which may be freely imported from the 'permitted' countries on the list to which the liberalisation of trade is applied, were announced this week.

These alterations which became effective on 15 February under Notice to Importers, No. 424, included the following additions to Open General Licence:—

Group 5—Chemicals, Drugs, etc.

Ammonium bicarbonate; bone tar; calcium chloride.

Anthracene and anthracene oil; benzol and benzene; carbolic acid (phenol); coal tar pitch coke; creosote oil; cresylic acid; high boiling tar acids; naphthas, solvent and heavy; naphthalene; tar bases, toluene (toluol).

Cyanides; disinfectants, insecticides and sheep and cattle dressings; ethyl abietate; fluorine compounds; formates; glycerine; hydrogen peroxide; lauryl pyridinium chloride; lime, whether hydrated or not; magnesium sulphate; manganese dioxide; mercury compounds; oxalates; pentaerythritol; phosphorus compounds; saffron; sulphate pitch; sulphurous acid; synthetic tanning substances, xanthates.

Group 2—Mineral Products and Metals.

Under sub-heading Powdered metals add zinc.

Group 3—Oils, Waxes, etc.

Under Oils: add copaiba, oleine (oleic acid), stearine (stearic acid), vitamin A.

Group 8—Machinery and Plant.

Under the heading Packaging, etc., Machinery: add bottling, capping and bottle washing machinery.

Group 17—Miscellaneous.

Under the heading Fertilisers: add bone, charcoal, etc.

Amendments under schedule II included the following:—

Group 5—Chemicals, Drugs, etc.

The item—Dyeing and tanning substances, natural, and extracts therefrom, not including spruce sulphite extract, sulphite cellulose and sulphite lye, amended to read—Dyeing and tanning substances, natural, and extracts therefrom.

Under the heading—Paints and painters' materials, the following: the item—Pigments and extenders, whether dry or with oil or with other medium, including metallic powders (except aluminium powder), but not including lithopone, amended to read—Pigments and extenders, whether dry or with oil or with other medium, including metallic powders (except aluminium powder).

The item—Sodium compounds, the following: Acid sodium pyrophosphate: sodium bicarbonate; borax; caustic soda; sodium glutamate; soda ash; sodium chlorate; sodium ferrocyanide; sodium silicofluoride, amended to read—Sodium compounds (including borax).

Sulphur Shortage

STEPS being taken to overcome the shortage of sulphur supplies were referred to by Mr. Hervey Rhodes, Parliamentary Secretary to the Board of Trade, in the House of Commons, last week.

Replying to a question about the serious effect of the reduction in sulphuric acid to rayon factories, Mr. Rhodes said that he was aware of the serious effects caused by the reduction of supplies of sulphur from the U.S.A., both for industrial use and for the manufacture of acid.

Representations were being made to the Americans to increase the allocation. To reduce our dependence on sulphur, plans were being made, in consultation with industry, to convert existing plants and to build new ones to burn other sulphur bearing materials, but this would take time.

A number of other projects were being pursued to substitute sulphur by other materials and to effect the maximum recovery of this material from other sources.

New Glycol Plant

THE Dominion Tar & Chemical Co., Ltd., has announced that the contract for the construction of its new Montreal East glycol plant and the facilities for extraction of ethylene gas, has been awarded. The new plant will extract ethylene from petroleum refinery gases and produce ethylene glycol and ethylene oxide. The major use of ethylene glycol is in the manufacture of anti-freeze, and there are other products that require a steady supply of this material. Another important use of ethylene oxide is in the manufacture of synthetic detergents, which are now being produced by one of Dominion Tar's associated companies.

One of the principal raw materials required for the glycol plant is chlorine which the company will obtain from its chlorine and caustic soda plant at Beauharnois, Quebec. Salt—the major raw material used in producing chlorine and caustic soda—is shipped to Beauharnois from one of the company's salt plants.

Trade Secrets and the Employer

by JOHN LAWES

IN considering applications for a vacant post, employers are naturally influenced by the qualifications and experience of the respective applicants. Someone who has actual experience of the type of work involved, all other things being equal, will be more likely to be appointed than an applicant with none.

While this is a normal procedure, there is some danger in that the successful and experienced applicant may make available to his new employer his knowledge of the particular methods of his previous firm, to the detriment of the latter. Some care is necessary if this particular situation does arise as an employee is under a duty not to break faith with his employer, even after his employment has ceased; if this trust should be broken he may lay both himself and the company with which he is now working, open to an action at the suit of his previous employer.

Should Be Examined

The limits to which an employee may make use of the knowledge which he may have acquired in his former positions should therefore be carefully examined.

Clearly, if a process has been patented, an employer may not make use of it merely because he has in his employment a man who was previously employed by the concern operating under the patent. There are, however, many types of knowledge which an employee picks up during the course of his work which, while they are not patentable, can be considered as trade secrets.

The employee is under a duty not to communicate information on these confidential matters to third persons, and this duty therefore debars him from making the information available to a subsequent employer. Should advantage be taken of this knowledge his former employer will be able to obtain an injunction preventing the information from being utilised.

Wherever there is a breach of this duty to keep faith it is for the former employer, who considers that his business interests are being prejudiced, to act; his remedy is an application for an injunction against both his former employee and against the latter's employer who is making use of the information. Damages may also be obtained.

The duty to keep faith only prevents the former employee from disclosing or making use of confidential information relating to his ex-employer's business, and it will not always be easy for an employer to be sure that he is not unwittingly taking advantage of the knowledge which one of his employees has of a competitor's business. Generally, however, one can define as confidential information, all those facts which would be regarded by both employer and employee as confidential, or would have been so regarded had they ever put their minds to this problem.

It is principally in dealing with technical specialists that there is a danger of picking up and using their former employer's trade secrets, but in the case of these employees, it will usually be found that their contract of service contains a restrictive covenant. In form, this covenant makes it a term of a man's contract of service that he will not, when his employment has ended, work for firms carrying on a business similar to that of his employer. Such covenants are not looked upon with any great favour by the Courts, but they are enforced if their scope is reasonable, that is, so long as the restraint which they impose on the employee is no more than is reasonably necessary to protect his employer's legitimate business interests.

Before appointing a specialist to a position, it is necessary to find out from him and from his previous employer whether he is bound by any such restriction on his activities. If he is bound by a valid restrictive covenant the employer for whose benefit such a covenant was imposed will be in a position to restrain him from entering the service of any concern, the activities of which come within the scope of the restraint, and will also be able to obtain an injunction preventing any such concern from employing the man.

Employer's Own Risk

The strict legal position has now been set out and it will be apparent that the employer who makes use of confidential information which one of his employees obtained in the course of a previous employment does so at his peril. The position in fact, however, is not quite so serious as it might first appear from a study of the law. This is because any concern which wishes to restrain another from using the special knowledge of one of its former employees must prove its case

before it can obtain the necessary injunction.

Knowledge of business life shows us how difficult a task this can be, and, in fact, only where the damage done by the disclosure is very great, will it be worthwhile to attempt to obtain an injunction.

Where a company has technical knowledge and processes which it is imperative should not be made available to competitors, there are two methods of protection readily available. The first is to have the processes patented, if they are patentable, or, where this is impossible, or undesirable, due to the publicity which necessarily attends a grant of Letters Patent, to impose restrictive covenants upon those of their employees who might disclose such information. The danger of a leakage is then slight, but if it should occur and can be proved, then an application for an injunction against the offending firm and employee will stop the gap.

Wide Use of Silicones

Promising Role in Rearmament

BECAUSE of their excellent production-increasing and product-improving properties, silicones will find wide use in America's rearmament programme, according to J. W. Raynolds, assistant manager of the American General Electric Company's chemical department. Terming silicones the most promising group of chemicals introduced to industry in many years, Mr. Raynolds told a meeting of the American Institute of Chemical Engineers that although much has been written about the silicones, their potentialities remain relatively unexplored. This is due in part, he said, to a lack of a simple and understandable approach to the question: How can silicones be profitably used?

This question can be answered most easily, Mr. Raynolds said, by a knowledge of the four chief things that silicones can do: Resist heat and cold; keep things from sticking; produce useful surface characteristics; and resist chemical attack.

In manufacturing processes, or in products where high or low temperatures are involved, silicones can be a big help, the speaker said. A new silicone rubber, he explained, retains its resiliency over a temperature range of from 550°F. to 85° below zero. High-speed military planes now being built are incorporating silicone rubber parts because of the greater assurance of positive gasketing action over a wide range of operating temperatures and atmospheric conditions.

Silicone oil is another good example of this high-low temperature property, Mr. Raynolds said. At the temperature of boiling water, the viscosity of silicone oil is reduced 50 per cent, but that of petroleum oil is reduced 90 per cent; and at 10 below zero, the viscosity of silicone oil increases 300 per cent, while petroleum oil increases over 30,000 per cent.

Silicone electrical insulation, because of its high temperature resistance, permits greater efficiency of motors and transformers, and silicone paints that withstand temperatures up to 750°F. have been formulated, it was stated.

Silicones, it was pointed out, can also aid manufacturers who have a sticking problem in their business by serving as an agent for releasing such materials as rubber, food, plastics, and cloth from contacting surfaces. Silicone emulsions, greases, and oils, because of their chemical inertness, high temperature resistance, and low surface tension, help manufacturers cut rejects and speed production. They are now being used to release rubber and plastics from moulds, metal from metal, bread from baking pans, and to safeguard ceramic insulators from contaminating materials.

The unusual surface characteristics of silicones are being put to use in automobile waxes and polishes. For years chemists have been looking for an ingredient that would permit them to formulate an easy-to-apply polish. It has been found, Mr. Raynolds said, that with proper formulation, silicone oils give car polishes ease of application, improved water repellency, and elimination of rainbow streaking.

Share Capital Acquired

THE whole of the share capital of Philips Spencer, Dakers & Co., Ltd., wholesale chemists, of Low Friar Street, Newcastle-upon-Tyne, has been acquired by Evans Medical Supplies, Ltd., of Liverpool, manufacturers of biological, fine chemical and pharmaceutical products. The name of this new subsidiary company has been changed to Evans Medical Supplies (Northern), Ltd., and the directors are Mr. Ian Fergusson (chairman and managing director of the parent company), Mr. H. Ashley Mason, Mr. W. A. Kinnear, and Mr. Charles W. Robinson (all directors of the parent company). The general manager is Mr. Norman McQueen, M.P.S., formerly managing director of Evans Medical Supplies (India), Ltd.

The Newcastle business was established in 1833 by a Mr. Dakers and was incorporated as a limited liability company in 1945.

Chemistry in Our Daily Life

Science as a Guide to Civilised Mankind

CHEMISTRY'S important rôle in a century of scientific achievement and development were described by Dr. D. McKie in his paper '1851-1951.'A Century of British Science' delivered to the Royal Society of Arts last Wednesday.

The history of science has in modern times witnessed three great revolutions: the revolution in mechanics in the 17th century, completed by our fellow-countryman, Newton, and marked by the publication of his *Principia* in 1687; the revolution in chemistry in the 18th century, carried through by Lavoisier's extension and synthesis of the classic discoveries of three British scientists, Black, Priestley and Cavendish, and signalised by the appearance of his *Traité élémentaire de Chimie* in 1789; and the revolution in biology in the 19th century, introduced in the work of another British scientist, Darwin, namely, *The Origin of Species*, published in 1859, which falls within the period under review. It has been easy for historians to name the 17th century 'The Century of Genius' and the 18th 'The Century of Enlightenment,' but it is not so easy to characterise the 19th century and still less so the period of a hundred years from 1851 to 1951, although we recognise readily enough that it has been an era of great achievement and multifarious development, much of which has occurred in the last half-century, during which time science has become the dominant factor in the life of mankind.

After dealing with astronomy, atomic structure and radio-activity, Dr. McKie turned to the progress of chemistry.

Important Discovery

In 1851 Frankland put forward the first clear ideas on valency, or the different combining powers of the elements, an advance which played a part in the establishment of the correct atomic weights and in the beginnings of stereo-chemistry, the study of the architecture of the molecule. But by far the most important advance in chemistry made at that period was Alexander Williamson's great research which gave, in the fog and confusion of chemical formulæ current in the middle of the 19th century, the correct constitutional formulæ of ethyl alcohol and ethyl ether as C_2H_5OH and $(C_2H_5)_2O$ respectively. This discovery was announced at the meeting of the British Association in Edinburgh in 1850: its results affected the whole realm of organic chemistry.

In 1851 about 60 elements were recognised. Odling in 1864-5 and Newlands in 1865, both British chemists, tried arranging the elements in groups of increasing atomic weight. Newlands, indeed, found that, in such an arrangement, 'the eighth element, starting from a given one, is a kind of repetition of the first, like the eighth note in an octave of music'—and he called this recurrence the Law of Octaves. So little acceptance was given to his idea that, at a meeting of the scientific society to which he read his paper, he was asked by a critic if he had tried to classify the elements alphabetically according to their names.

Royal Society Recognition

However, his brilliant observation should not be forgotten, even while giving every credit to the more thorough presentation of the Law of Periodicity of the elements by the great Russian chemist, Mendeleeff, in 1869. Newlands was, in fact, awarded the Davy Medal of the Royal Society in 1887.

The discovery of argon by Rayleigh and Ramsay in 1894, followed by the isolation by Ramsay and Travers of the other inert, and rare, gases present in the atmosphere, added a whole column or family of new elements to the Periodic Table from that least suspected source, our common air. The 92 elements of the Table have now been increased by the so-called 'transuranic elements'; and the periodicity in their properties has been explained in terms of their atomic structure, a very far cry from our knowledge in 1851.

In organic chemistry, the preparation in the laboratory from their elements, the synthesis, of substances found only in organic sources, in plants or animals, was begun in the 1860's by the celebrated French chemist, Marcelin Berthelot; and thereafter it proceeded apace with ever-increasing speed with all the magnificent syntheses of complicated organic molecules that characterised the development of organic chemistry during the later part of the 19th century and the first half of the present century.

These achievements are so vast that in a short time little more can be said, than that British organic chemists have played a great part in this work.

Especially was this evident in the elucidation of the structure of such naturally occurring substances as the alkaloids, terpenes and anthocyanins, in extending our knowledge of substances which are useful in medicine, but which do not occur in Nature, as, for example, the antimalarials. A similar range of useful substances, entirely laboratory products, the plastics, must also be mentioned.

In biochemistry, largely an off-shoot of chemistry in the present century, there have been many remarkable developments. Best known of all probably is Sir Frederick Gowland Hopkin's discovery of the 'accessory food factors,' later known as the vitamins, without which a diet, although adequate in regard to the energy that it can supply to the organism, is unsatisfactory and, indeed, inimical to health and survival. The results of this discovery on the health of nations are inestimable.

Britain's Share

Today, a whole range of these substances is known and the constitutions of many of them have been investigated and established, and they have been synthesised and made in the laboratory and on the manufacturing scale. British science played a great part in this work. Hormones, discovered by Bayliss and Starling, can have only a brief mention here in a rapid survey. The use of radio-active isotopes to follow chemical changes in body tissue is a recent and new technique of great importance.

In chemo-therapy, the development of the so-called 'sulpha' drugs has brought a new weapon into the hands of the physician in the treatment of pneumonia and of cerebro-spinal and puerperal fevers, and other 'killing' diseases. The most successful, 'sulpha-pyridine,' better known as 'M. and B. 693,' synthesised by Ewins and Phillips, has deprived the once-dreaded pneumonia of the name applied to it by Osler, quoting from Bunyan, 'Captain of the Men of Death.' The discovery of penicillin and of its properties by Fleming in 1929, and its development as an antibiotic by Chain and Florey in 1940 are recent major advances in this field.

In the period from 1851 to 1951 British scientists have played as great a part as those of other nations. If we refer to the awards of Nobel Prizes in the three fields of physics, chemistry, and medicine and physiology, we find that in the 50 annual awards since their institution in 1901, British scientists have been awarded the prize for physics on 13 occasions, a number exceeding that of any other country—it seems that we still hold the lead in physics that Newton gave us in the 17th century; in chemistry, the Nobel Prize has been awarded to British chemists on seven occasions.

In the hundred years that we are here considering, the study of science as a profession has really begun in our universities—this was far from the case in 1851. The state itself has organised and developed scientific services: to name only two, the Government Laboratory, which existed only in a simple form in 1851, and the National Physical Laboratory. The keynote of science in the universities is research. The output of scientific literature, of scientific and technical journals, has enormously increased; the degrees of specialisation have become finer and finer.

In our daily life, the different sciences, especially chemistry touch our lives at almost all points. Health and disease, the length of life, diet and vitamins and malnutrition, the preservation of food, refrigeration, epidemics, artificial fabrics and other products made in the laboratory, synthetic drugs, dyes, detergents, fertilisers, fuels and other sources of power in general, even the construction of roads and houses, above all public health—to name a mere few—in all these science is the guide of civilised mankind. In the daily life of the individual citizen science everywhere now plays some vital part or other—and the very life of the state of which he is a citizen depends on the progress and application of science, not only for the maintenance of its prosperity alongside that of other states in time of peace, but also for its survival in war, science having now become a most, if not the most, important factor in the preservation of military security.

Dominant Rôle of Science

The great change that has come to pass since 1851 is that science now enters almost every activity of our daily lives, Much of this change is due to the realisation of the value of science by industry after the war of 1914-18. It was aptly said of scientists by Lord Balfour, before the 20th century opened and long before, as an 'elder statesman,' he had become Lord President of the Council and thereby head of the Department of Scientific and Industrial Research: 'They are the people who are changing the world and they don't know it. Politicians are but the fly on the wheel—the men of science are the motive power.'

Yet, despite its dominant rôle in our lives and despite its many applications, science is pursued by its devotees in general for that worthiest and greatest of all purposes, the disinterested love of truth for truth's sake.

Research Key to Survival

Teaching at University Level

THE need for Great Britain to keep in the forefront of scientific research and in the application of science to industry, was emphasised by Professor E. D. Adrian, O.M., president of the Royal Society, at the annual luncheon of the Parliamentary and Scientific Committee held in London recently.

Teaching of science at a university level cost a great deal, far more that it used to, and to teach technology at that level, cost even more.

The universities were nearing the end of their five-year period of reconstruction, for which they had received generous funds. It was not always realised how much they had done in building laboratories and improving teaching.

Lean years lay ahead of us all, continued the professor, but he hoped that every effort would be made to see that this country was not allowed to fall behind in training its young men and women.

In technological subjects the number of students at the universities had been more than doubled, and before long, if plans could be carried through, the output of university-trained technologists would not be far short of the requirements of industry.

Lord Samuel, president of the committee, said that science was becoming increasingly recognised as of the highest importance.

Referring to Mr. Herbert Morrison, the committee's other guest, Lord Samuel said that as Lord President of the Council he held the office nearest to that of a Minister of Science, and he had always given encouragement to scientists.

Stimulation of scientific research said Mr. Morrison was not the only need. It was also essential to help the nation to catch up with scientific discoveries and make the best use of them. Better and more economic use of raw materials, was one of the most pressing problems.

The Process Manufacturing Department at the works of Kay Brothers Limited—the Redditch, Stockport, adhesives, insecticides and verminicides manufacturers—was destroyed by fire on Tuesday of last week. The above picture was taken after the worst part of the fire was over and shows the dense smoke being carried away by the strong breeze

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University's Rôle

Glasgow's Influence Since 1747

THE important rôle played by Glasgow University in the instruction of chemistry was outlined by Professor J. W. Cook, Regius Professor of Chemistry, in his fifth-centenary commemoration lecture delivered at the University last week.

In 1747, when it was decided to set up an independent lectureship in chemistry at Glasgow, there was little provision for such instruction in the British universities with the exception of a chair at Cambridge founded in 1702, and one at Edinburgh founded eleven years later.

The institution of a chemistry course at Glasgow was due to William Cullen, who came to found a medical school, and was convinced that this was essential to his plan. He established a break with tradition by delivering his lectures both in chemistry and medicine in English, instead of in Latin.

Glasgow's second lecturer in chemistry, Joseph Black, must be counted among the immortals of chemistry. His classical work on magnesia, fixed air, lime, and mild and caustic alkalis, had been carried out earlier in Edinburgh. It was the first systematic chemical investigation involving the use of the balance and helped to elevate chemistry to the rank of an exact science.

Black's immense influence was exercised at a very formative period in Scottish culture. All five of those who succeeded him in the chemistry lectureship were his pupils—John Robison (1766-1769), later Professor of Natural Philosophy at Edinburgh; William Irvine (1769-1787); Thomas Charles Hope (1787-1791), who isolated the first known compound of strontium and succeeded Black in the Chair of Chemistry at Edinburgh; Robert Cleghorn (1791-1817), and Thomas Thomson (1817-1818).

Thomas Thomson, who was a prolific writer on chemical and other topics, was in 1818 elevated to the newly instituted Regius Chair, a post which he retained until his death 34 years later. He was an active worker at the laboratory bench, and the first to teach his students practical chemistry.

In 1852, Thomson was succeeded by Thomas Anderson, chemist to the Highland and Agricultural Society, who was followed by John Ferguson in 1874.

Ferguson, who continued in office until 1915, was a scholar and leading authority on the literature of chemistry and early alchemy. His foremost work, *Bibliotheca Chemica*, was a descriptive catalogue of the well-known James Young collection at the Royal Technical College, Glasgow.

Among Ferguson's pupils, who afterwards became noted chemists, were William Ramsay, John Millar Thomson, Arthur Smithells, J. J. Dobbie and G. G. Henderson. The last named was a distinguished organic chemist and an outstanding figure in 20th century Glasgow chemistry. After 27 years as professor of chemistry at the Royal Technical College, he occupied the Regius Chair from 1919 until 1937.

The early years of this century saw the institution of lectureships in organic chemistry, physical chemistry, and metallurgical chemistry. T. S. Patterson was appointed to the organic lectureship in 1904, and became the first incumbent of the Gardiner Chair when it was founded fifteen years later.

Tetraethyl Lead Process

THE development of a new continuous process for the manufacture of tetraethyl lead has been announced by E. I. Du Pont de Nemours & Co., Inc. In revealing perfection of the new process by its research men and engineers, Du Pont said that construction will start immediately on the first new continuous production unit which will have an annual production capacity of about 50,000,000 lb. of tetraethyl lead a year.

At the present time tetraethyl lead is made in batches. In addition to increasing productive output, the new continuous process eliminates the need for equipment made of special steel alloys. It is said to result from advanced engineering design, and a major change in the basic chemical process, but details were not revealed by the company.

The plant, to be located at Deepwater Point, New Jersey, is expected to be in production by January, 1952. Sodium to supply its needs will be furnished in part by the adoption of a new process now being installed at Memphis, Tennessee, for production of sodium cyanide from hydrogen cyanide and caustic.

Swiss Chemical Exports in 1950

Exports of chemical and pharmaceutical products from Switzerland last year were again marked by an increase in value, the total (in million Swiss francs) being 556.9 compared with 504.4 in 1949. Dyestuffs and pharmaceuticals shared the leading position, the value in each case amounting to 221.8 francs. Industrial chemicals accounted for 84.6 francs as against 70.5 francs in 1949, while shipments of perfumery amounted to 28.7 francs.

Technical Publications

LATEST developments in industry and research relating to the fields in which it is interested are summarised in a booklet issued by L. H. Manderstam & Partners, Ltd., London. The bulletin is now in a new form to permit the more satisfactory reproduction of photographs and diagrams. A number of the abstracts quoted are taken from THE CHEMICAL AGE.

A SURVEY of the U.S. Patent system and the more favourable outlook for the inventor and patent owner are discussed by Dr. Robert Calvert in *Chemical and Engineering News* (Vol. 29, No. 3).

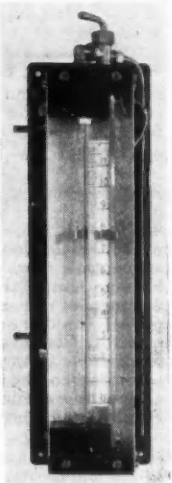
CHEMISTRY in the twentieth century is summarised and possible future developments predicted by Harold C. Urey in "Science . . . and Tomorrow," a symposium published in the January issue of the *Journal of the Franklin Institute* which marks its 125th anniversary issue.

THE largest phosphorous-producing unit in the world—Monsanto Chemical Co.'s sixth furnace—is described and illustrated in *Chemical Industries Week* (Vol. 68, No. 1), under which title the former *Chemical Industries*, a McGraw-Hill publication, appears in its new weekly guise. Many of the old features are retained, but, as the editorial points out, it was felt that flexibility and timely coverage were easier in a weekly than a monthly periodical.

TECHNOLOGY is now available practically to eliminate smoke and handle most of the fly-ash problems in air-pollution, according to Hammett P. Munger, who is in charge of air pollution research at Battelle Memorial Institute, Columbus, Ohio, in an article in the *Midwest Engineer* (Vol. 3, No. 5). By means of continuous aerosol collectors, it will be possible, the author points out, to obtain the variation of the total aerosols present throughout the day and night.

'WHEN PLANNING Complete Chemical Plant' is the title of a new folder by Bamag, Ltd., which summaries the complete installations supplied to some 25 countries, including the U.S.A. Photographs are included of nitric acid plants in England and Spain, of a solvent extraction plant in South America, of a vegetable oil extraction and processing plant in Syria, an Indian hydrogenation plant, an electrolyser in Eire and a continuous fat splitting plant. The folder is in English, French and Spanish.

A NEW universal manometer of single tube type has been designed by George Kent, Ltd., of Luton. It is suitable for use with a wide range of pressures, suctions, or differential pressures, using mercury, water, or oil for the filling liquid and is arranged for use in a vertical or inclined position, and for wall or flush mounting.



Known as the STL manometer, the new instrument has a vertical scale and is very simple in construction. An application where this manometer gives special advantages is in a gas works where a bank of manometers may be required for an extremely wide range of suctions (*e.g.* 0-12 in.) and pressure (*e.g.*, 0.48 in.). The new instrument can be used as a standard fitting in all these varying conditions.

Scale lengths of 12, 24, 36, 48 and 60 in. are available. With mercury as the manometer liquid, therefore, the maximum scale reading possible is over 800 in. water gauge. Two inclined positions are standard, giving ratios of 1:2 and 1:3 of vertical head to scale length. Thus a 12-in. manometer inclined to the 1:3 position will give a full scale reading for a 4-in. change of head. Maximum static working pressure is 150 p.s.i., while test pressure is 300 p.s.i. Accuracy is within 0.1 per cent over the whole range. The scale may be calibrated in inches of head of manometer liquid or in units of flow of gas or liquid (flow range 1:10).

ISOMANTLES have now been recognised as an ideal heating method for all glass and porcelain plant and are being increasingly employed in laboratories and chemical factories. Four new patterns have now been produced by J. W. Towers & Co., Ltd., who first introduced electric heating mantles to this country. An illustrated leaflet describing these new types is now available.

Chemical Library Acquired

Duveen Collection Acquired

THE University of Wisconsin has recently purchased one of the major collections of books on chemistry and related fields now available in the U.S.A. —the Dennis I. Duveen chemistry library.

In recommending the purchase of the collection, which will cost $50,000, the faculty committee noted that it 'reveals a diversity and completeness which is probably not equalled anywhere,' and pointed out that it 'shows remarkable strength in all the periods of development.'

The collection includes the Latin alchemical works of Geber, Lull, Dee, Kelley, and Maier; the most significant writings of the medical period by Paracelsus, Glauber, Boerhaave, and others; books by Becker and Stahl, founders of the phlogiston theory; and writings of the period when the foundations of modern chemistry were laid by important French, English, and German chemists.

The committee listed sections of the collection which would be unusual assets to the University chemical holdings. These include:—

'The Crell Journals,' published in the latter part of the 18th century and devoted exclusively to pure and applied chemistry. All six of the journals, more than 70 volumes, are in the collection, a total matched only by the Library of Congress.

'Essays of the Accademia del Cimento,' which represent some of the basis foundations in physical science of a period when Italian science was foremost.

'Histories of Chemistry,' a collection published during the past century by noted authors, now out of print.

Wisconsin items include 'Elements of Chemistry,' published in 1839 by David Boswell Reid, who later became a faculty member, and Moissan's 'Electric Furnace' as translated by Victor Lenher, a member of the Wisconsin chemistry faculty for a quarter of a century.

East German Chemical Expansion

Construction of a phosphorous furnace is reported to have been begun at the nitrogen works, Piesteritz, in East Germany. On its completion it is hoped not only to satisfy the requirements of East Germany, but also to have an exportable surplus of phosphoric acid. Plans are said to be under consideration for the construction next year of a carbide furnace.

Control of Scrap Metal Prices

MAXIMUM prices for non-ferrous scrap metals came into force on 3 February and an order to that effect, the Non-ferrous Metal Prices Order (S.I. 1951, No. 155), was announced by the Minister of Supply, Mr. G. R. Strauss.

Prices of non-ferrous metal scrap have recently been reaching inflated levels, according to the Ministry, in many cases scrap being offered at prices in excess of virgin metal.

The Order, made after consultation with the trade, is intended to discourage hoarding and stabilise prices in relation to those of virgin metal.

It is intended in the near future to institute licensing arangements for the acquisition of non-ferrous scrap and secondary metal, and for the rendering of periodical stocks returns. It is hoped to avoid having to introduce a detailed distribution scheme.

For remelted lead the price has been fixed at £126 a ton compared with a quotation of £136 for the virgin metal. Remelted zinc is priced at £145 a ton as against £151 for virgin zinc. The highest grade of scrap copper has been set at £180 a ton, compared with £202 for electrolytic bars.

A formula for fixing the maximum prices of any material not included in the list is contained in the Order. All prices are subject to reduction for inferior quality or lack of cleanliness.

Bona fide scrap merchants may add to their selling prices a merchanting charge not exceeding 1¼ per cent for lead scrap, and 2 per cent for other materials, except remelted lead for which no margin is permitted. Charge for bagging must not exceed 9d. per bag.

Extension of the control to secondary copper and copper alloy ingots, which are not at present included in the Order, is under consideration.

To Revive Industry

An application to lease land at Warrington for a building for the manufacture of glass chemical apparatus has been made by Mr. J. Hewitt, of Penketh. The Council has instructed Mr. J. P. Aspden (Town Clerk) to negotiate with Mr. Hewitt on leasing him a piece of land in Hawleys Lane, Warrington. The new factory will mark the revival of one of the town's oldest industries. Glass making was started in Warrington in 1640 by John Leaf, who had premises in Church Street, and the industry lasted until Robinson's glass works closed down in 1933 on the transfer of the works to Stourbridge.

The Chemist's Bookshelf

NITROCELLULOSE: Herstellung und Eigenschaften (Manufacture and Properties) By Dipl.-Chem. Dr.-Ing. Karl Fabel. Ferdinand Enke Verlag, Stuttgart. 1950. Pp. VIII + 211. DM. 18.60.

The title of this new book is more sweeping than its contents. The disclaimer coyly secreted in the author's foreword, stating that the book does not cover the whole of nitrocellulose science, would really have come better if indicated as a subtitle on the cover. In fact the book deals with nitrocellulose the plastic, not the highly esterified explosive. Within this field it seems to cover the ground well and, in general, systematically. Forming part of a collection of 'Chemical Technology of the Plastics in Single Volumes,' it is intended to help plastics chemists and engineers as a critical digest of the recent scientific, technical and patent literature.

Dividing his work into two parts, the author first discusses present tendencies in the manufacture of the product, and then its properties. For some peculiar reason, an historical review follows immediately before the indexes. There is one other rather surprising arrangement. A patent review is interpolated into the manufacturing part of the book between general discussion of the chemistry of the nitration process and the account of the actual technical procedures. This patent review is an exceedingly useful compilation—bearing in mind the exaggerations and limitations of all patents claims—summarising 150 patents in Germany, Italy, France, Britain and the U.S.A. spread over the past 15 years. It really merits a more prominent position in the book and some subject side-headings.

In his opening words Dr. Fabel excuses himself for perpetuating the misnomer 'nitrocellulose" in place of the more accurate name 'cellulose nitrate' on the ground of extensive usage in the interested industries. This is quite reasonable. Far less reasonable, however, is the limitation of the tables of commercial grades to lists of I.G. products. Only for one of these grades is the equivalent given in a WASAG and a Hercules grade. Corresponding British grades are not mentioned. In this respect an advertising brochure of any of the nitrocellulose manufacturers is more informative.

The defects however are easily remediable in a further edition. The book generally fulfils the claims of the author's foreword. It will help the plastics chemist and engineer to keep up-to-date on trends in nitrating acid composition, stabilisation of the product and after-treatments such as viscosity reduction and final water removal. In the properties section there are included short summaries of the position on compatability with other high polymers, solubility, light stability and stability to bacterial attack. The treatment throughout is very condensed but appears adequate and references are given which will permit anyone interested to read the fuller story.

Binding and printing are pleasantly done, but the price (if the exchange rate is about DM. 11 to the pound) is rather high at about 32s. 9d. Nevertheless, libraries should have this book.—I.B.

THE ENDLESS YEARS. John Barnard. Chantry Publications, London, 1950. 8s. 6d.

As the international news grows more and more depressing and the activities of politicians, tax gatherers and our other masters at home make the domestic outlook almost equally grim, it is a tonic and an inspiration to read 'The Endless Years' by John Barnard.

Barnard and other officers and men of his battalion who survived the brief but violent Japanese invasion of Malaya in 1941 were taken prisoner in Singapore and soon afterwards set to work on the building of the Bangkok-Moulmein railway, justly described as 'the railway of death.' The book is Captain Barnard's day-to-day diary of his long years in captivity. Reading the diary one immediately finds a new meaning for the old motto 'Never Say Die.'

Great numbers of Barnard's fellow prisoners died of disease and starvation, or were literally worked to death, far away in the jungle, cut off from the world and news of their friends and families. But those who survived never gave up hope. We need not despair of our country while it continues to breed such men.

· PERSONAL ·

The Anglo-American Oil Co., Ltd., announce that MR. D. A. C. DEWDNEY, research manager of Esso Development Company since 1949, has been appointed co-ordinator of refinery operations. He will be responsible for co-ordinating all the refining and manufacturing activities of the Anglo-American Oil Company with other departments and affiliates of the company centred on the new Esso refinery at present being built at Fawley. After graduating in science at Birmingham University, where he was a Cadman Medallist and took a first class honours degree, he spent several years in the Middle East, as a refinery chemist.

Anglo-American Oil has also announced the appointment of MR. GEORGE NOBLE as refinery manager, in charge of all refining and manufacturing activities at the Esso Refinery, Fawley. Mr. Noble has held important positions of responsibility in the petroleum industry for the past twenty-one years, including those of assistant process manager and assistant maintenance superintendent at the Sarnia refinery of the Imperial Oil Company of Canada. At the Fawley refinery he has advanced from the position of Superintendent of Technical Services to Assistant Refinery Superintendent and Refinery General Superintendent.

DR. FRANK MAYO, Ph.D., has been appointed Assistant Refinery Manager in charge of refinery operations, including Process, Mechanical and Technical activities. Dr. Mayor has been concerned with refinery activities for the past sixteen years and in the Fawley refinery has advanced from Plant Chemist through responsible positions, including those of Superintendent of Technical Services and Process Superintendent. He has recently been engaged as Assistant General Superintendent at Fawley in charge of all training activities preparatory to the operations of the new facilities. Dr. Mayo is a Chemical Engineering Graduate, with Honours, of Birmingham University During the war he was engaged in research activities with the Petroleum Warfare Department.

MR. C. R. YOUNG is appointed Assistant Refinery Manager in charge of Administration and Staff Departments, including Employee Relations, Accounting, Public Relations and Medical. Mr. Young has been engaged in the petroleum industry for the past twenty-nine years, having had experience in Persia and Rumania before transferring to the Anglo-American Oil Company in 1941. He spent a period with the Petroleum Warfare Department and the Petroleum Board before coming to Fawley in 1946 as Process Superintendent. He was promoted to Assistant General Refinery Superintendent in 1948. Mr. Young is an Honours Graduate in Chemistry of London University.

DR. GUSTAV EGLOFF, president of the Western Society of Engineers in 1949-50, and director of research for the Universal Oil Products Company, has been selected by the academic senate of the University of Edinburgh to deliver its biennial "Romanes Lecture in Chemistry" for 1951. The doctor, who is vice-president of the third World Petroleum Congress, will attend its meeting at The Hague from 28 May to 6 June, and will lecture on the "Polymerisation of Olefinic Hydrocarbons."

OBITUARY

Readers will hear with deep regret of the sudden death on 31 January, 1951, of MR. H. J. HODSMAN, M.B.E., M.Sc., F.R.I.C. Mr. Hodsman had been hon. secretary and treasurer of the Yorkshire Section of the Society of Chemical Industry since 1931.

EMERITUS PROFESSOR T. W. FAGAN, of The Crossways, Llanbadarn Road, Aberystwyth, died in Aberystwyth General Hospital, on 10 February after a short illness. Aged 77, he had been Professor of Agricultural Chemistry at Aberystwyth University College of Wales. A native of Talysarn, Caernarvonshire, he took his degree at Caius College, Cambridge, and was later appointed a Fellow of the Royal Institute of Chemists. Before moving to Aberystwyth in 1919, he was a lecturer at Edinburgh University. He retired in 1939 after investigating the nutritive value of herbage plants.

The death occurred on 12 February of MR. ROBERT CROOKS STANLEY, chairman of the International Nickel Company of Canada, Limited. Associated with the International Nickel Company from its formation in 1901, and its leader for the past 28 years, he was virtually the architect of what is today one of Canada's foremost enterprises, an achievement which placed him in the front rank of the world's industrialists.

· OVERSEAS ·

Czechoslovakia Making PVO

The manufacture of polyvinyl chloride has recently been taken up in Czechoslovakia, the product being marketed under the name of *Novodur*. Experiments are under way to produce a Novodur thread suitable for the manufacture of hosiery.

New Sealing Liquid

A new sealing liquid called 'anaerobic permafil' has been developed by the G.E.C. Company of Schenectady, New York. It is said to provide a more effective seal than varnishes or paints, unlike varnish the liquid portion polymerises and hardens without evaporation. It will seal metals, glass, mica, fabrics and paper and may be painted on porous substances to make them airtight. Threaded joints in pipes can also be sealed with permafil. At present it is being produced only for research purposes.

Harder Steel by Cooling

By immersing steel in liquid nitrogen and cooling to about 184°C., and immediately forging or rolling it, American metallurgists have produced a metal of unusual hardness. If the steel is later heated at controlled temperatures an even harder product is formed which, in addition, has a greater resistance to corrosion than ordinary steel. The new technique was developed by N. A. Ziegler, of the Crane Company of Ohio, and P. H. Brace, of the Westinghouse Electrical Company, Pennsylvania. They point out that neither the cold treatment nor forging alone will produce a superior hardness. The two processes must be used together.

Nitrogen Plant for Iceland

A nitrogen works with an annual capacity of 6,000 tons is being erected in the vicinity of Reykjavik, capital of Iceland. The plant is to be connected with the hydro-electric power plant on the Sop Falls. American capital has provided U.S. $1.5 million or more than half the total cost.

Chile to Introduce Colour Standards

To increase the quality of colours used in the country, the Chilean Ministry of Public Works recently announced that it is preparing colour standards. Imports of colours and dyestuffs will in future be subject to permission by the State Material Testing Board.

French Synthetic Rubber

The French Minister of Commerce is reported to have requested representatives of the country's chemical industries to prepare a plan for the establishment of synthetic rubber works. The plan, which was to have been ready by the middle of January, is to be examined as a matter of urgency by several Ministers concerned. France possesses no synthetic rubber works at present, requirements being covered by imports from the U.S. This development assumes special importance in connection with the suggestion made recently by the Chairman of Dunlops Limited that this country might have to consider the establishments of such plants.

Stock Offered to Employees

The Dow Chemical Company of Midland, Michigan, recently announced the issue of a prospectus offering shares of its common stock at $57.50 (U.S. funds) to all its employees and to employees of subsidiary and associated companies. It is the first time Canadian employees have been offered the opportunity to participate in the offer.

Further Expansion Planned

British Guiana plans for a further expansion of the bauxite industry, involving not less than $1,500,000, have been announced. Another new drying kiln will be added to the plant at Mackenzie, and the railway transportation facilities will be augmented. The operation of the new kiln will mean a production capacity increase of 400,000 tons of dried bauxite a year, an appreciable rise in output on the 1950 figure of approximately 1,600,000 tons of dried ore shipped.

Lower French Steel Output

Preliminary estimates indicate a decline of crude steel output in France from 9,152 million tons in 1949 to about 8,650 million tons last year. Rolled products also declined from 6,176 million tons to approximately 5,950 million tons, while production of pig-iron was only 7,730 million tons last year compared with 8,345 million tons in 1949.

Swiss Trade with Indonesia

A trade agreement between Switzerland and Indonesia was signed in Berne last month. Exchange of goods to a value of 30 million Swiss francs was planned during the current year. In exchange for Indonesian produce Swiss exports will include dyestuffs, indigo, and instruments.

Next Week's Events

MONDAY 19 FEBRUARY

Electrodepositors Technical Society

London: Northampton Polytechnic, St. John Street, Clerkenwell, E.C.1., 6 p.m. A. Smart: 'Factors Influencing the Design of Automatic Plating Plant.'

TUESDAY 20 FEBRUARY

Royal Institute of Chemistry

Wigan: Mining and Technical College, 7 p.m. Dr. A. F. H. Ward: 'Viscosity of Lubricating Oils at High Rate of Shear.'

London: Norwood Technical College, Knights Hill, S.E.27, 7 p.m. Dr. H. N. Rydon: 'Rational Chemotherapy.'

Agriculture Group (SCI)

London: Royal College of Science, South Kensington, 2.30 p.m. Dr. A. Carruthers: 'Sugar-Beet Production.'

Society of Chemical Industry

London: Royal Society of Tropical Medicine and Hygiene, Manson House, Portland Place, W.1. Dr. L. Valentine: 'Copolymerisation.'

The Royal Society

London: Burlington House, Piccadilly, W.1, 4.30 p.m. Paper read by E. K. Rideal: 'The Photochemistry of Native Proteins.'

WEDNESDAY 21 FEBRUARY

Royal Institute of Chemistry

Loughborough: The College, 7.15 p.m. D. S. P. Roebuck: 'Silicones.'

London: 1 Wimpole Street, W.1, 6.30 p.m. Professor A. C. Frazer: 'The Biochemistry of Fat Absorption.'

Sheffield: City Memorial Hall, 7 p.m. Sir J. D. Cockroft, F.R.S.; 'The Research Work of the Atomic Energy Establishment.'

British Association of Chemists

Derby: Electricity Showrooms, 7.15 p.m. M. Ruhemann: 'Recovery of Ethylene and Propylene from Oil Gases.' (Jointly with Institute of Fuel.)

The Plastics Institute

London: Waldorf Hotel, Aldwych, W.C.2, 6.30 p.m. Dr. J. T. Scales: 'Plastics in Surgery.'

THURSDAY 22 FEBRUARY

Royal Institute of Chemistry

Edinburgh: North British Station Hotel, 6.30 p.m. Dr. H. W. Thompson: 'Some Aspects of Infra-Red Measurements.'

Chester: Grosvenor Hotel, 7.15 p.m. N. Swindon: 'Submerged Combustion.'

Stockton-on-Tees: William Newton School, Junction Road, Norton, 7.30 p.m. Sir Charles Goodeve: 'Physical Chemistry in the Iron and Steel Industry.'

The Chemical Society

Aberdeen: Marischal College, 7.30 p.m. Professor R. M. Barrer: 'Ion Exchange in Crystals.' (Jointly with RIC and SCI.)

Nottingham: The University, 6.30 p.m. Professor H. W. Melville: 'The Breakdown of Macromolecules.' (Jointly with University Chemical Society.)

FRIDAY 23 FEBRUARY

Electrodepositors Technical Society

Sheffield: Sheffield University, St. George's Square, 6.30 p.m. W. J. Smellie: 'The Soldering and Brazing of Metals.'

The Plastics Institute

Manchester: The Engineer's Club, Albert Square, 6.45 p.m. J. L. Daniels: 'Developments in Plastic Moulding Plant.'

The Chemical Society

Newcastle: Chemistry Building, King's College, 5 p.m. Bedson Club Lecture: Professor A. Robertson: 'Metabolic Products of Moulds.'

St. Andrews: United College, 5.15 p.m. Dr. H. W. Thompson: 'Some Aspects of Infra-Red Measurements.' (Jointly with St. Andrew's University Chemical Society.)

Southampton: University College, 5 p.m. Professor C. A. Coulson: 'What is a Chemical Bond?' (Jointly with Southampton University College, Chemical Society.)

SATURDAY 24 FEBRUARY

Royal Institute of Chemistry

Bradford: Technical College, 2 p.m. Conference on 'The Training of the Chemist.' (Jointly with the Bradford Chemical Society).

Reading: Zoology Lecture Theatre, The University, 2.30 p.m. Dr. C. G. A. Hill: 'Luminescence in Inorganic Chemistry.'

Institution of Chemical Engineering

Birmingham: Latin Theatre, The University, Edmund Street, 3 p.m. C. T. Meiklejohn and P. D. Coppock: 'The Behaviour of Gas Bubbles in Relation to Mass Transfer.'

HOME

British Industries Fair

The stands which have been allocated to Benn Brothers Limited (proprietors of THE CHEMICAL AGE and other trade and technical journals) at the B.I.F. are as follows: Castle Bromwich, A.427; Olympia, A.14.

Chemical Registrations

The total number of chemical companies registered in England and Wales in the year ended 31 December, 1950, was 380 with a total capital of £2,065,940 according to Jordan & Sons, Ltd. Three chemical companies were incorporated with initial capitals of over £50,000: Biller & Crispe, Ltd. (£200,000); Glazebrook (Holdings), Ltd. (£300,000); British Potash Development, Ltd. (£300,000).

Training Research Workers

The 'perhaps old-fashioned' view that emphasis in university post-graduate work should be on training a new generation of research workers rather than on making scientific discoveries, was referred to by Sir William Halliday, principal of King's College, University of London, at the annual dinner last week.

Great impetus, he said, had been given during the war to scientific research divorced from teaching, and such work had since been carried on by research institutions, many of them under Government auspices.

Since the war, however, scientific interest seemed to have shifted to the border lines of the older sciences with the result that many research programmes required workers of greater maturity.

ETS Annual Conference

Brochures and application forms are being circulated to all members of the Electrodepositors Technical Society for the Annual Conference which is to be held at the Grand Hotel, Torquay, from 11-14 April.

Junior Dyers' Society

Mr. A. E. Battye, a member of the research department of Tootal, Broadhurst, Lee and Co., Ltd., Manchester, gave an address to members of the Junior Dyers' and Colourists' Society at Bradford Technical College (last night) on "Synthetic Resins in Textiles Fibres."

The society has a growing and active membership, now 50 compared with about 35 last year. Among its members are half a dozen young ladies.

Price Alterations

Albright & Wilson, Ltd., have announced that their current prices for phosphorous, phosphoric acid, sodium phosphate and carbon tetrachloride are as follows:—Phosphorus, red 4s. per lb.; Phosphorus, white 3s. 1d. per lb.; Phosphoric Acid Technical S.G. 1,500 £71 per ton; Phosphoric Acid B.P. S.G. 1,750, 1s. 2½d. per lb. (ton lots carriage paid). Sodium phosphate: Di Sodium Crystalline, £34 10s. per ton; Di Sodium Anhydrous, £73 per ton; Tri Sodium Crystalline, £36 10s. per ton; Tri Sodium Anhydrous, £70 per ton; Carbon Tetrachloride, no change.

Export Licenses Needed

Under an Order made by the Board of Trade, coming into operation on 12 February, export licences will be required for all destinations for candles and certain similar articles, specified fatty acids, antimony, vanadium and zinc and their alloys in certain forms, nickel ores and concentrates, some further types of used steel materials, cobalt compounds, naphthalene, sulphuric acid, and anthraquinone.

From the same date licences will be required in respect of corundum, certain plastic materials, carbonyl iron powder, molybdenum carbides, certain scientific apparatus, and various chemicals, for export to all destinations other than those specified in Part II of the Third Schedule.

January Steel Record

The last of the monthly output figures for Britain's steel industry to be issued prior to nationalisation showed that a new record of production was achieved in January. Despite the period being affected by the New Year holidays, production was at the annual rate of 15,907,000 tons compared with 15,873,000 tons in January, 1950, and 15,408,000 tons in December, 1950. Pig iron output was at the rate of 9,520,000 tons a year as against 9,742,000 tons in January last year.

Train Fire Inquiry

Recommendations designed to reduce the risk of fire were made by Colonel R. J. Walker, an inspecting officer of railways, in a report on the fire in a Birmingham-Glasgow express which occurred near Beattock Summit on 8 June. The report stated that the lacquer used as an interior finish, though not so sensitive to ignition as other types, had 'a rapid spread of flame' and should be replaced by some other material.

The Stock and Chemical Markets

STOCK market activity has been well maintained due mainly to last-minute switching from steel shares into other industrials before the exchange into nationalisation steel stock became due. Dealings in the new steel stock will have started by the time these notes are in print. At the time of writing the prevailing view is that it is likely to be at a discount because there is bound to be a good deal of selling by old holders of steel shares who now realise that the exchange into steel stock will mean a big loss of income. Nevertheless, if steel stock offers a slightly more attractive yield than other gilt-edged stocks with similar redemption dates, it would be expected of course that buyers would be attracted, and that the new steel stock would shortly settle down and move closely with the general trend of the gilt-edged market. Industrials have generally moved higher again, but this was due to further selling earlier in the week of steel shares and reinvestment of the proceeds. Sentiment was helped by dividend announcements, which in many cases have borne out market hopes of increases. On the other hand, there is an undertone of caution developing, because it is feared that tax increases in the next Budget may be so heavy that few companies will be able to pay more to shareholders. Nevertheless the prevailing view is that for the present, markets will remain active, although business must be expected to slacken off in the weeks preceding the Budget.

There have been small irregular movements in chemical and kindred shares. Imperial Chemical at 44s. 9d. lost a small part of their rise. The good yield brought in buyers for Fisons around 27s., and bigger dividend talk in the market put Monsanto higher again at 54s. Laporte 5s. units continued to change hands over 11s. and William Blythe 3s. shares transferred at 8s. 9d. Albright & Wilson were 16s. 6d., Amber Chemical around their par value of 2s., while Boake Roberts changed hands at 32s. 6d. F. W. Berk 2s. 6d. shares have been firm at 12s. 9d. on the new issue and share bonus proposals. In other directions, Bowman Chemical 4s. shares were 5s. 9d., Brotherton 10s. shares 21s. 6d. and Pest Control 5s. shares were dealt in around 7s. 6d. Lawes Chemical 10s. shares marked 12s. 4½d., Cooper McDougall & Robertson 26s. 3d. and elsewhere, British Chemicals & Biologicals 4 per cent preference were 17s.

Borax Consolidated at 60s. 3d. remained steady, awaiting the financial results. British Oxygen were around 97s. with British Aluminium at 42s. 6d. while Turner & Newall were active on talk of prospects of a further dividend increase this year, and changed hands over 91s. Triplex Glass at 25s. 9d. have been well maintained at which there is a yield of about 4⅞ per cent on the basis of last year's 12½ per cent dividend on these 10s. shares, but the market is hopeful the dividend may be raised to at least 15 per cent. On the other hand, as has been pointed out before, dividend prospects of many companies will, of course, depend on the extent to which taxation is increased by the next Budget. United Glass Bottle at 85s. have been very firm. A further sharp advance to 27s. in General Refractories was attributed to higher dividend hopes. Elsewhere, British Xylonite at 87s. 6d. have been steady with De La Rue at 27s., British Industrial Plastics 2s. shares 7s. 3d. and Kleemann 1s. shares 14s. 9d. Glaxo Laboratories again changed hands around 64s. at which there is a yield of only 2¼ per cent, but this is an instance where the market assumes that there are good prospects of a dividend increase. Boots Drug were 48s. 9d. and British Glues & Chemicals 4s. shares firm at 23s. 9d. Oils were generally higher with Shell favoured on hopes that the dividend may be raised to 12½ per cent, tax free. Anglo-Iranian also rallied, helped by the company's new tanker plans which will require £21,000,000 but will not necessitate raising additional capital.

Market Reports

LONDON.—A persistent demand has been reported from almost all sections of the market and, with the supply position becoming increasingly difficult, values have a tendency to higher levels. Quotations for tartaric acid and cream of tartar have been advanced and higher prices are now ruling for bichromates particulars of which have not come to hand at the time of this report. Boric acid and borax are to be raised by 70s. and 50s. per ton respectively as from 12 March. These higher prices are the result of increased costs of mining, ocean freights and wages. With regard to the general run of soda and potash products, routine contract deliveries are being maintained on a satisfactory scale, but orders for prompt delivery are difficult to place, and the

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Law and Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

R. A. HOPKINS, LTD., Luton, chemists. (M., 17/2/51.) 19 December, debenture to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *Nil. 5 July, 1950.

PHILBLACK, LTD., Bristol, manufacturers of carbon black, etc. (M., 17/2/51.) 8 December, £500,000 'A' notes with a premium of 2½ per cent secured by a Trust Deed dated 5 May, 1949, and supplemental Deed dated 23 November, 1950; charged on specified properties; and a general charge. *£600,000.

PLASTOCRAFT PRODUCTS (DARWEN), LTD., plastic goods manufacturers. (M., 17/2/51.) 14 December, debentures to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *— 13 October, 1949.

STARKEY & SON, LTD., London, W., chemists. (M., 17/2/51.) 19 December, £3,500 mortgage to Abbey National Building Society; charged on 106 and 108 Holland Park Avenue, Notting Hill. *£1,000. 3 November, 1949.

Increases of Capital

The following increases in capital have been announced: JACOB COWEN & SONS, LTD., from £30,000 to £60,000; A. BELLAMY & CO., LTD., from £50,000 to £70,000.

Company News

British Industrial Plastics

Net profit of British Industrial Plastics for the year ended 30 September, 1950, was £111,201 (£90,087). A final dividend was recommended of 12 per cent on the ordinary shares, which with an interim payment of 8 per cent brings the total for the year to 20 per cent, less tax. In the past three years a single payment of 20 per cent has been paid annually.

F. W. Berk and Co.

A capital bonus and a rights issue of new shares were announced this week by F. W. Berk and Co., chemical manufacturers and merchants. The directors propose the creation of two million ordinary shares and to offer ordinary holders registered on 12 March 800,000 ordinary shares in the proportion of two for three. Price will be decided later. It is also proposed to capitalise £150,000 from reserves for an issue of 1,200,000 ordinary shares to holders on 12 March on a one-for-one basis.

Evans' Acquisition

Evans Medical Supplies announce the acquisition of the whole of the share capital of Philips Spencer, Dakers & Co., wholesale chemists of Newcastle-on-Tyne. The name of the new subsidiary company has been changed to Evans Medical Supplies (Northern), Ltd.

Monsanto Chemical Company, U.S.

A quarterly dividend of 62½ cents per share on outstanding common stock, payable on 1 March, is announced by the U.S. Monsanto Chemical Company.

THE STOCK AND CHEMICAL MARKETS

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position is aggravated by the scarcity of suitable containers. The increase in the prices of red and white lead reported last week have been made because of the higher costs generally of wages and works and office overhead expenses. Trade in the coal tar products market remains brisk for such materials as are on offer. The tone in this section is strong.

MANCHESTER.—Pretty well all descriptions of heavy chemicals have met with a steady demand on the Manchester market during the past week. The textile and allied trades and other leading industrial users are pressing for deliveries under contracts and a steady flow of replacement buying on home consumption account has been reported. Shippers have also been prominent in the market with offers of fresh business. The marked shortage of certain lines continues in evidence. Some fertilisers are meeting with a steady demand. Most of the tar products are active and makers are well sold forward.

GLASGOW.—There has been very considerable activity in the Scottish heavy chemical market during the past week, and, in general, the shortage of supplies of most chemicals is giving rise to very numerous inquiries.

1,3 Butylene Glycol

THE Chemical Division of Celanese Corporation of America has announced the start of commercial production of 1,3 Butylene Glycol. This new Celanese product, a high boiling solvent and coupling agent, can be used as a humectant, solvent and lubricant in the textile, paper coating, printing paste and dye, and hydraulic fluid fields. Low toxicity and hygroscopicity suggest its application in the tobacco, cosmetic and pharmaceutical industries.

Celanese Butylene Glycol is also a versatile intermediate for surface active agents, alkyl resins and rosin esters and allows the production of polyester plasticisers with high dielectric constants for use in electrical insulation compounding.

Celanese is also introducing, for the first time in continuing commercial quantities, 2,3 Butylene Glycol. The adjacent hydroxyl groups of this glycol make it interesting as a chemical intermediate for cosmetics, pharmaceuticals, resins, elastomers and chemical specialities. Its physical properties suggest application in vapour set and stamp pad inks, speciality soaps, textile compounds and adhesives.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

CHEMICAL ENGINEER required for important **SUGAR PLANT** in **PERU.** Attractive salary and conditions, good prospects for right man under 30, preferably unmarried, including free accommodation, free transportation and home leave every three years. Write full details to Box C. 692 c/o Jackson's 16 Gracechurch Street, London, E.C.3.

CROWN AGENTS FOR THE COLONIES

TEMPORARY LABORATORY SUPERINTENDENT (MALE OR FEMALE), required by the Government of Sierra Leone for Agricultural Chemical Research for 2 tours, each of 18 to 24 months in the first instance. Commencing salary according to qualifications and experience in the scale £774, rising to £942 a year (including allowances). Outfit allowance £60. Gratuity of £25 for each 3 months service on satisfactory completion of contract. Alternatively employer's contributions to F.S.S.U. may be paid if desired in lieu of gratuity. Free passages and liberal leave on full salary. Candidates should have had sound laboratory training in a recognised laboratory and should be Associates of the Royal Institute of Chemistry, or hold a degree in chemistry or a certificate of the Institute of Medical Laboratory Technology. Apply at once by letter, stating age, full names in block letters and full particulars of qualifications and experience, and mentioning this paper to the : **Crown Agents for the Colonies, 4, Millbank, London, S.W.1,** quoting M.26602 G, on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications, and will communicate only with applicants selected for further consideration.

DESIGN ENGINEERS, with B.Sc. Degree in Mechanical Engineering or equivalent, and not over 40 years of age, are required by The Bahrein Petroleum Company, Limited. Experience to have been in design of Oil Refineries, coal tar, chemical distillation or similar plants, involving electrical and steam systems, pressure vessels, fractionating columns, heat exchange and pumping equipment. Salaries according to qualifications and experience, plus kit allowance. Provident Fund. Free board and air-conditioned accommodation, medical attention. Low living costs. Two-year agreements with paid leaves and transportation. Write, giving full particulars of age, education and experience, to **Box 3785, c/o Charles Barker & Sons, Ltd., 31, Budge Row, London, E.C.4.**

OIL Refinery Contractors handling large contracts for Refinery Plant, require **CONTRACT ENGINEERS** in their London Office. Duties involve broad direction and co-ordination of all phases of the work, including planning, drafting, purchasing, progressing and erection. Desirable qualification is previous experience of Refining Industry or Heavy Engineering, including a wide knowledge of pumping, heat-exchange equipment and instrumentation, and the appointment offers excellent prospects to suitable men. Applicants should write fully, stating qualifications, age and experience, to **Foster Wheeler, Ltd., 3, Ixworth Place, London, S.W.3.**

PLANT DEVELOPMENT AND PROCESS ENGINEERS, qualified in Chemical Engineering or Petroleum Refining Technology, required by Bahrein Petroleum Company, Limited. Age limit, 25-40. Two-year agreement periods with passages and paid leaves. Free air-conditioned accommodation, board and medical attention, kit allowance, low living costs. Salary according to experience. Write, with full particulars of age, education, experience, to **Box 3784, c/o Charles Barker & Sons, Ltd., 31, Budge Row, London, E.C.4.**

SITUATIONS VACANT

QUALIFIED CHEMIST required to take charge of works laboratory in large Heavy Organic Chemical Works in the Midlands. Experience of laboratory control essential. Salary according to age, qualifications and experience. A contributory pensions scheme is in operation. Apply to Box No. C.A. 2986, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

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